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Audit

Validity of fine needle aspiration cytology in diagnosing thyroid gland neoplasms

Priyani AAH[1], Ileperuma A[1], Fernando R[1]

Abstract

Objectives: To determine the validity of Fine needle aspiration cytology (FNAC) in diagnosing thyroid neoplasms and to identify the causes of false positive and negative results.

Method: Thyroid FNACs of 100 patients with subsequent histology were analysed. The diagnostic categories used included Thy 1 to Thy 5. Thy 3 was subdivided into Thy 3a and Thy 3b depending on the presence or absence of features suggestive of a follicular neoplasm. Histology results were categorized as neoplastic or non neoplastic. Results of FNACs were correlated with histology.

Results: FNAC predicted the presence of neoplasms with a sensitivity of 77.7.8%, specificity of 83% and had a diagnostic accuracy of 90%. The false negative rate was 8% and the cause was non diagnosis of impalpable papillary micro carcinomas.

Conclusion: Sensitivity could be increased by ultrasound scan guided aspiration in non palpable lesions. Sub categorization of Thy 3 into a and b increases the specificity of FNAC in detecting thyroid malignancy.

Key words: FNAC, thyroid, neoplasm, pitfalls

Introduction

Autopsy studies have demonstrated the prevalence of thyroid nodularity as approximately 37%, of which 12% are solitary nodules (1). The incidence of thyroid nodules in the general population is approximately 4-5% (1). Since only a minority of these nodules are malignant, it is necessary to differentiate the non neoplastic from the neoplastic nodules. Many investigations are used to differentiate malignant from benign lesions in the thyroid, but there are drawbacks in each technique. FNAC is widely accepted as the most accurate, specific and sensitive diagnostic procedure in evaluating thyroid nodules preoperatively (2,3,4,5,6). Studies have shown that ultrasound scan guidance (USS) improves the adequacy of preoperative thyroid cytology but not the diagnostic accuracy (7). FNAC performed by experienced pathologists and onsite cytological evaluation to check adequacy has

[1]*Department of Pathology, National Hospital of Sri Lanka, Colombo, Sri Lanka.*

Correspondence: Priyani AAH, Department of Pathology, Faculty of Medicine, University of Colombo, Sri Lanka. e-mail: priyaniaah@yahoo.com

improved the adequacy even without USS guidance (8). Several complex reporting systems of thyroid cytology have resulted in confusion. Some centres have used a numerical system from Thy 1 to Thy 5, increasing the reproducibility of diagnosis and giving a diagnosis related to therapy (9).

Objective

To determine the sensitivity, specificity, diagnostic accuracy and the positive and negative predictive value of FNAC in diagnosing thyroid neoplasms and identify the causes for false positive and false negative results.

Materials and methods

One hundred thyroidectomy specimens with preoperative FNAC results were selected for the study. The numerical reporting system used in Portsmouth, UK (9) and the recommended guidance on the reporting of thyroid cytology specimens by the Royal College of Pathologists, UK were used (10). The morphological criteria for these cytological diagnostic categories and related thyroid conditions for each category have been described (10,11,12,13,14,15).

Diagnostic Category	Morphological Criteria
Thy 3 Possible follicular neoplasm 3a – Non-diagnostic (definite distinction between a follicular neoplasm and a hyperplastic nodule is difficult.) 3b – Suggestive of a follicular neoplasm	The smears with follicular pattern but insufficient to suggest a follicular neoplasm were categorised as Thy 3a. Smears with follicular pattern suggestive of or suspicious of a follicular neoplasm and Hurthle cell tumours were categorized separately as Thy 3b. This category includes; 1. hypercellular smears as compared to most aspirates of nodular goiter and demonstrates a monotonous population of follicular cells with minimal or absent background colloid. Colloid when present is thick instead of watery colloid. 2. Smears with cells arranged in three-dimensional groups and micro-follicles with prominent nuclear overlapping and crowding. 3. Cellular aspirates comprising one-cell population of Hurthle cells in a background of minimal colloid. The cells can be arranged in monolayer sheets, follicular groups or as scattered single cells.
Thy 4 Suspicious for malignancy	Aspirates showing features suspicious of malignancy but do not allow confident diagnosis due to some reason (low cellularity, mixed cell patterns)
Thy 5 Malignant	Aspirates can be confidently diagnosed as malignant

Table 1. Cytological diagnostic categories and the morphological criteria

The diagnostic categories used in this study are shown in table 1.

A positive cytology result was one which predicted or definitely diagnosed a neoplasm, including the malignant (Thy 5), suspicious for malignancy (Thy 4) and follicular proliferations suggestive of a follicular neoplasm (Thy 3b) categories. A negative cytology result was designated to one which definitely showed benign features (Thy 2)and follicular proliferation where a definite distinction between follicular neoplasm and a hyperplastic nodule was difficult (Thy 3a). The histology of all benign lesions including colloid storing goitre, colloid cyst, chronic autoimmune thyroiditis (including Hashimoto's thyroiditis) and hyperplastic nodules were considered as negative histological diagnoses and all neoplasms including follicular adenoma, follicular carcinoma, Hurthle cell neoplasms, papillary carcinoma, medullary carcinoma, anaplastic carcinoma and lymphoma were considered as positive histology. Cytological-histological correlation was done and the specificity, sensitivity, diagnostic accuracy and positive and negative predictive value of FNAC in predicting thyroid neoplasms were calculated. All discordant cases were reviewed for any evidence of needle insertion into the lesion concerned, including possible needle tract lined by granulation tissue with fibrosis and past haemorrhage. The discrepant smears were analysed to identify the cause of the discrepancy.

Results

Table 2 and 3 show the results of the cytological and histological correlation.The number of true positives, true negatives, false positives and false negatives are given in table 4. In this study, FNAC predicted neoplasia with a sensitivity of 77.78% and a specificity of 96.83%. The diagnostic accuracy was 89.0% with a positive predictive value of 93.33% and a negative predictive value of 88.41%. Overall, 89 cytological diagnoses out of 100 cases in the study sample showed concordant results with histology. Both cytology and histology slides of discordant cases were reassessed to identify the possible cause for the errors. Table 5 shows the cytological and histological diagnoses of discrepant cases.

Discussion

Thyroid FNAC is the widely accepted diagnostic technique for the pre-operative assessment of thyroid nodules, but it also has several disadvantages. Many series have shown high (7-20%) inadequacy rates (4,5,6). In this study the inadequacy rate was 1%.

In previous studies the specificity is between 96% -100% (2,4,6,17,18). In two studies in which specificity and sensitivity have been calculated for detecting thyroid neoplasms, cytological category 3 (Follicular proliferation), in addition to 4 and 5 has been included as positive cytology smears. In these two studies the specificity of detecting neoplasms was 67% and 73% and sensitivity was 55% and 86%, with a positive predictive value of 65% in one study (3,5).The current study shows a comparatively higher specificity and a positive predictive value of 96.83%, and 93.33% respectively. Separation of cytological diagnostic category 3 (Thy 3) in to two subgroups, according to the presence (3b) or absence (3a) of suspicious cytological features of follicular neoplasm, and consideration of those smears with suspicious features as positive cytological diagnosis and those without such features as negative cytological diagnosis increased the specificity

Cytology / Histology	Non-diagnostic –Thy1	Benign (non-neoplastic) – Thy 2	Possible follicular neoplasm - Thy 3a – Non-diagnostic (definite distinction between a follicular neoplasm and a hyperplastic nodule is difficult.) Follicular proliferation with no adverse features hyperplasia	Suggestive of a follicular neoplasm - Thy 3b	Suspicious for malignancy – Thy 4	Malignant - Thy 5	Total histology
Lymphocytic or Hashimoto's thyroiditis	00	09	01	01	00	00	11
Multi nodular goitre	01	48	02	00	01	00	52
Follicular adenoma	00	01	00	00	00	00	01
Minimally invasive follicular/ Hurthle cell carcinoma	00	01	00	00	00	00	01
Widely invasive follicular/ Hurthle cell carcinoma	00	00	00	04	00	01	05
Papillary carcinoma	00	05	01	01	04	12	23
Total cytology	01	65	04	11	06	13	100

Table 2. Histological diagnoses for different cytological diagnostic categories

Cytology / Histology	Inadequate (Thy 1)	Benign (Thy 2)	Follicular proliferation with no definite diagnosis (Thy 3a)	Follicular proliferation Suspicious of a neoplasm (Thy 3b)	Suspicious of Malignancy (Thy 4)	Malignant (Thy 5)	Total
Non-neoplastic	01	58	03	01	01	00	64
Neoplasm	00	07	01	10	05	13	36
Total	01	65	04	11	06	13	100

Table 3. Cytological diagnoses in relation to the final histological diagnosis

	Negative cytology	Positive cytology	Total histology
Negative histology	True negatives 61	False positives 02	Total negative histology 63
Positive histology	False negatives 08	True positives 28	Total positive histology 36
Total cytology	Total negative cytology 69	Total positive cytology 30	Total 99*

Table 4. The number of true positive and negative, false positive and negative results
*One had inadequate sampling on cytology with a benign histology

in our study but the sample size is small and studies with larger samples are required. The sensitivity of detecting thyroid neoplasms by FNAC in our study was 77.78% and negative predictive value to exclude neoplasia was 88.41%. These values were within the range of values reported in comparable studies (3,5). Five out of eight false negatives were papillary micro carcinomas without any evidence of having been sampled at FNAC.

Ultrasound scan guided aspiration may reduce the false negative rate in such situations. One such study has excluded neoplasia with a sensitivity of 80.5% and negative predictive value of 95.9% (19). Studies have shown a high rate of malignancy, 21.6% in incidentally detected thyroid nodules at sonography, hence the diagnostic value of US guided FNAC is

Case number	Cytology	Histology
1	Colloid goitre (Thy 2)	Follicular adenoma
2	Colloid goitre (Thy 2)	Incidental papillary micro carcinoma in a multinodular goitre
3	Colloid goitre (Thy 2)	Follicular variant of papillary carcinoma (6mm)
4	Colloid goitre (Thy 2)	Papillary microcarcinoma in chronic autoimmune thyroiditis
5	Colloid goitre (Thy 2)	Papillary microcarcinoma in a large MNG
6	Colloid cyst (Thy 2)	Cystic papillary carcinoma in Hashimoto's thyroiditis
7	Colloid goitre (Thy 2)	Minimally invasive follicular carcinoma
8	Follicular proliferation with no definite diagnosis (Thy 3a)	Papillary microcarcinoma within a hyperplastic nodule
9	Follicular proliferation suspicious of a neoplasm (Thy3b)	Hashimoto's thyroiditis with a hyperplastic nodule
10	Suspicious of papillary carcinoma (Thy 4)	Colloid goitre

Table 5. The cases with discrepant histology

vital (20).

Ten out of 11 cytological diagnoses that were categorized under Thy 3b were confirmed to have malignancy in histological sections. Similarly, three out of four cytological diagnoses categorized under Thy 3a were confirmed to have non malignant thyroid lesions. This finding indicates that categorising follicular pattern into two groups according to the presence or absence of suspicious features for a neoplasm is a satisfactory method of discriminating cellular follicular lesions. Further study with a larger sample size is required to reproduce these results. Most of the diagnostic discrepancies were due to sampling error.

The significantly high sensitivity and specificity of thyroid FNAC confirms it to be a reliable tool in the assessment of thyroid neoplasms.

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