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Accuracy of Fine Needle Aspiration in Categorization of Thyroid Lesions

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Abstract

Background: Fine needle aspiration cytology has been shown to be simple, safe, cost effective and quick to perform procedure with excellent patient compliance. It is a well established technique for preoperative investigation of thyroid gland swellings with high sensitivity, specificity and accuracy. The aim of this study was to determine the accuracy of fine needle aspiration cytology of thyroid swellings performed at our institution. *Materials and Methods:* This study was carried out at American International Institute of Medical Sciences and Hospital Udaipur, department of Pathology over a period of 2 years (May 2015 to May 2017). One hundred and ninety patients of all age groups and both sexes who underwent fine needle aspiration cytology for thyroid swelling were evaluated. Out of 190 patients, histopathological diagnosis was carried out in 69 patients. *Results:* Fine needle aspiration cytology result revealed 156 cases (82.10%) as non-neoplastic, 20 cases (10.52%) as neoplastic and 14 cases (7.38%) inadequate due to lack of cellularity. The commonest lesion in the thyroid gland was colloid goiter. Among the malignant neoplasms the commonest was papillary carcinoma. Out of 176 patients, histopathological diagnosis was available in 69 patients. Statistical analysis of our data shows the diagnostic accuracy of fine needle aspiration cytology to be 91.30%. Fine needle aspiration cytology showed a sensitivity of 90.90% and a specificity of 91.37%. *Conclusion:* Fine needle aspiration cytology is a well established technique for pre operative investigation of thyroid gland swellings with high sensitivity, specificity and accuracy.

Keywords: FNAC; Sensitivity; Accuracy.

Introduction

Enlargement of the thyroid gland is commonly seen in iodine deficient areas, where the prevalence may be as high as 40% [1]. The development of goiter causes considerable amount of fear in the minds of patients as well as the clinicians, as the swelling can be malignant in nature. Most of the thyroid swellings are benign in nature and even in the cases of solitary thyroid nodules selected for surgery on clinical grounds, malignancy is found in only around 10% [2].

Fine needle aspiration cytology (FNAC) is a simple, readily available, reliable, time saving and minimally invasive, cost effective procedure. It has high sensitivity and specificity. FNAC has decreased unnecessary surgeries. It can distinguish benign from neoplastic or malignant thyroid nodules, thus influencing the therapeutic decisions.

The aim of this study was to confer the accuracy of fine needle aspiration cytology of thyroid swellings with histopathological correlation.

Materials and Methods

This study was carried out at American International Institute of Medical Sciences Udaipur, department of Pathology over a period of 2 years (May 2015 to May 2017). Total 190 patients of all age groups and both sexes who had undergone FNAC for thyroid swelling were evaluated. Out of 190 patients, histopathological diagnosis was available in 69 patients.

Fine needle aspiration cytology was performed

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without local anesthesia with the help of the non-aspiration technique, using 24 gauge needles. Multiple passes were made through the centre and the periphery of the swellings. Both air-dried and alcohol fixed smears were made from the aspirated material. The slides were stained with Leishman and Papanicolaou (PAP) stains. Histopathology slides were stained with Haematoxylin and Eosin (H&E) and were reviewed.

FNAC results were classified into four groups:

1. Inadequate material.
2. Non-neoplastic (goiter, thyroiditis, cystic lesions, thyrotoxicosis).
3. Neoplastic (follicular neoplasm, hurthle cell neoplasm).
4. Malignant (papillary carcinoma, anaplastic carcinoma).

FNAC results were compared with final histopathological diagnosis in 69 patients. The sensitivity, specificity, accuracy, false positive rate (FPR) and false negative rate (FNR) of FNAC for detection of malignant lesions were calculated.

Results

A total of 190 patients with various thyroid lesions were diagnosed and treated at our hospital during the period of May 2015 to May 2017. In all the cases, pre-operative FNAC was done and diagnosis was recorded. Out of 190 cases, unsatisfactory material was obtained in 14 cases and satisfactory material was obtained in 176 cases. Out of 176 cases, 69 cases were operated and histopathological correlation was done.

Most of the cases were seen between the 3rd to 5th decades of life (78.94%). Benign lesions were found most commonly between 3rd to 4th decades of life and malignant lesions were found in 5th to 6th decades of life. The youngest patient in our study was a 12 year old girl; while oldest was a 75 year old woman. [Table 1].

In 14 cases, smears were unsatisfactory. Out of 190 cases studied, 163(85.78%) patients were female while 27 (14.22%) were male. Thus the thyroid lesions showed female predominance with the male to female ratio1:6.

On FNAC, out of 176 cases, 156 (88.63%) patients were diagnosed with non-neoplastic lesions, 7 (3.97%) patients with neoplastic lesions and 13 (7.38%) patients with malignant lesions. Goiter was the most common non-neoplastic lesion, which represents 59.65% (105 cases). Follicular neoplasm was the most common neoplastic lesion accounts for 2.84% (5 cases). The incidence of papillary carcinoma was 6.81% (12 cases) while anaplastic carcinoma was 0.45% (1 case) [Table 2].

Out of 176 cases, 69 patients were operated and histopathological correlation was made. Table 3 shows correlation between FNAC and histopathological examination. Out of 156 non-neoplastic lesions, 58 were histopathologically correlated. Out of these 58 cases, 53 cases were confirmed by histopathological examination with accuracy rate of 91.37% and false negative results were seen in 9.63% (5 cases).

Amongst the non-neoplastic lesions, 105 cases were diagnosed as goiter on FNAC; out of these 40 cases, in 37 cases FNAC diagnosis of goiter was confirmed on histopathology, while in remaining 3 cases the diagnosis deferred as these cases had neoplastic lesion on histopathological examination. The FNAC accuracy rate for goiter was found to be 92.50%.

Out of 26 cases of thyroiditis, only 6 cases were histopathologically correlated. The remaining patients had been treated medically or the follow up was lost. The accuracy rate in cases of thyroiditis was 100% on FNAC.

Amongst 25 cases of nodular goiter, 12 cases could be histopathologically correlated. Out of which 10 were found to be consistant with FNAC diagnosis while other 2 cases came out to be neoplastic on histopathology.

In seven cases, which were diagnosed as neoplastic lesions on FNAC. 5 were of follicular neoplasm. Out of 5 cases of follicular neoplasm, 4 cases were histopathologically correlated. Amongst these 4 cases, 2 cases showed features of follicular adenoma, 1 case showed follicular carcinoma & 1 showed nodular goiter on histopathological examination. Out of 2 cases of hurthle cell neoplasm, 1 case was histopathologically correlated and it showed hurthle cell adenoma. Here, the accuracy rate of FNAC for neoplastic lesion was calculated to be 80% with false positive rate of 8.62%(1case).

Out of 13 cases which were diagnosed as malignant on FNAC, 12 cases were papillary carcinoma and 1 case was of anaplastic carcinoma. However histopathological correlation was available only in 6 cases of papillary carcinoma. All 6 cases turned out to be papillary carcinoma on histopathology. Therefore, accuracy rate for papillary carcinoma was 100% on FNAC.

Table 1: Age wise distribution of thyroid lesions

Age Group	No. of Cases
11-20 years	12
21-30 years	65
31-40 years	47
41-50 years	38
51-60 years	18
Above 60 years	10
Total	**190**

Table 2: FNAC categorization of thyroid lesions

FNAC diagnosis	No. of patients (%)
Non-neoplastic lesions	
Colloid goiter	105 (59.65%)
Nodular goiter	25 (14.20%)
Lymphocytic thyroiditis	18 (10.22%)
Hashimoto's thyroiditis	07 (3.97%)
Reidle's thyroiditis	01 (0.56%)
Neoplastic lesions	
Follicular neoplasm	05 (2.84%)
Hurthle cell neoplasm	02 (1.13%)
Malignant lesions	
Papillary carcinoma	12 (6.81%)
Anaplastic carcinoma	01 (0.56%)
Total	**176**

Table 3: Cytodiagnosis and its correlation with histopathological diagnosis of various thyroid lesion

Thyroid lesion		No. of cases in FNAC	Histopathological correlation			Accuracy rate (%)
			Total	Correct	Incorrect	
Non-neoplastic Lesion	Colloid goiter	105	40	37	03	92.50
	Nodular goiter	25	12	10	02	83.33
	Thyroiditis	26	06	06	00	100
	Lymphocytic thyroiditis	18	02	02	00	100
	Hashimoto's thyroiditis	07	04	04	00	100
	Reidle's thyroiditis	01	00	00	00	_
	Total	**156**	**58**	**53**	**05**	**91.37**
Neoplastic lesion	Follicular neoplasm	05	04	03	01	75
	Hurtle cell neoplasm	02	01	01	00	100
	Total	**07**	**05**	**04**	**01**	**80**
Malignant lesion	Papillary carcinoma	12	06	06	00	100
	Anaplastic carcinoma	01	00	00	00	_
	Total	**13**	**06**	**06**	**00**	**100**
Total		**176**	**69**	**63**	**06**	**91.30**

Table 4: Comparison of sensitivity, specificity and accuracy with other studies

	This study 2017	Bouvet M et.al15 1992	Kessler A et al16 2005	Gupta M et al14 2010	Mundasal B et all12 2006
Sensitivity	90.90%	93.5%	79%	80%	52%
Specificity	91.37%	75%	98.5%	86.6%	86.6%
Accuracy	91.30%	79.6%	87%	84%	79.1%

Discussion

FNAC helps significantly in the preoperative investigation of patients presenting with thyroid swelling, however despite its well recognized value there are certain limitations associated with this simple minimally invasive diagnostic technique. The reported pitfalls are those related to the specimen adequacy [3,4], sampling techniques, the skill of the aspirator performing the aspirations, the experience of the cytopathologist interpreting the aspirate and overlapping cytological features between benign and malignant lesions and inadequate, indeterminate FNA. One of the major limitation of thyroid cytology is its inability to distinguish between follicular adenoma and follicular carcinoma [4,5,6,7]. This diagnosis require detail histological examination for vascular or capsular invasion and cannot be reliably made on routine FNAC smears [8,9,10,11]. Hence, the term follicular neoplasm (lesion) is used in FNAC.

Several other tests, such as high resolution ultrasonography, radioisotope scanning and FNAC have been used for evaluation of thyroid swellings before proceeding to thyroid surgery [12].Studies have demonstrated that among all these diagnostic modalities, FNAC is the most accurate, cost effective screening test for rapid diagnosis of thyroid swelling [13].

The sensitivity and specificity of FNAC technique in diagnosing the pathology in thyroid nodules is reported to be 65% to 98% and 72% to 100% respectively. The FNAC has been shown to have similar or even higher sensitivity and accuracy levels than frozen section examination [14]. In the published data [12,14,15,16], the sensitivity, specificity and accuracy of thyroid FNAC in detecting thyroid lesions ranges from 52-93%, 75-98% and 79.1 to 87% respectively (table IV). In our study the specificity and the accuracy rate of FNAC was observed above 91%. The determinant factor for such a wide range of sensitivity, specificity and accuracy may be, how the cytopathologists classify the "suspicious" as well as the false positive and the false negative samples.

Table 4 shows comparison of sensitivity, specificity and accuracy of present study with studies of various authors. Published data suggest the percentage of inadequate sample between 9-13% [19]. In our study, the sample inadequacy was observed in 7.36% of cases (14 cases). The most important factors determining the sample adequacy include experience of the person who is doing aspiration and the criteria used to define a satisfactory sample.

In our study the false negative rate was 9.9% (5 cases). Different studies showed false negative results ranging from 1.5% to 11.5% [17,18]. In the present study, three cases diagnosed as colloid goiter on FNAC proved to be follicular adenomas (two cases) and papillary carcinoma (one case) on histopathology. Sampling areas selected for these cases on FNAC was the reason for misdiagnosis. In other two cases of nodular goiter, the high cellularity was misinterpretated and neoplastic diagnoses were missed. In our study one case (8.62%) was diagnosed as a follicular neoplasm on FNAC, which on histopathology turned out to be nodular goiter. A sampled focal are of high cellularity of the lesion could have lead to misdiagnosis on FNAC. This is near to the range of other studies, which have showed false positive rates ranging from 0 to 8% [17,18].

Conclusion

Fine needle aspiration cytology is a well established technique for pre operative investigation of thyroid gland swellings with high sensitivity, specificity and accuracy. This technique is almost non-invasive, cost effective and free of complications in expert hands and an efficient method of differentiating benign and malignant lesions, except for follicular neoplasm thereby reducing unnecessary surgeries.

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