Original Article

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Effectiveness and Significance of Fine Needle Aspiration Cytology in the Diagnosis of Thyroid Swelling: A Single Institute Experience in a Series of 710 Patients

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Abstract

Context: Thyroid swelling is a relatively common problem encountered in clinical practice throughout the world. Early detection of thyroid neoplasm is the fundamental basis of thyroid screening. A quest for ease, simple and accurate diagnostic tool that would differentiate between benign and malignant lesion has facilitated fine needle aspiration cytology (FNAC) as the first line tool in the initial thyroid evaluation. *Aims:* The study was aimed at classifying thyroid lesions according to the Bethesda System for Reporting Thyroid Cytopathology and to compare the diagnostic efficacy of fine needle aspiration cytology by correlating with gold standard histopathology. *Settings and Design:* This prospective cross-sectional study was conducted over a period of two years in a tertiary hospital, Kerala. *Methods and Material:* A total of 710 patients were included in the study. FNAC was performed and Staining was performed with Haematoxylin & Eosin (H&E), Papanicolaou and May-Grünwald Giemsa Stains. Diagnosis was made based on TBSRTC. Excision biopsies were fixed in 10% formalin. *Statistical Analysis used*: IBM Statistical Package for the Social Sciences Software version 21 was used to perform Pearson Chi-square test and Fischer Exact. *Results:* In this study 592 (83.4%) cases of non-neoplastic lesions, 111 (15.6%) cases of neoplastic lesions and seven cases were found unsatisfactory for diagnosis. FNAC showed high sensitivity and specificity in diagnosing neoplastic thyroid lesions and it showed high level of significance in diagnosing papillary thyroid carcinoma. *Conclusions*: FNAC is an excellent diagnostic tool in the management of thyroid lesions since it provides rapid diagnosis with high accuracy rate.

Keywords: Bethesda System; Neoplasm; Histopathology; Papillary Thyroid Carcinoma.

Introduction

Thyroid swelling is a relatively common problem encountered in clinical practice throughout the world. Though majority of these lesions are non-neoplastic still it might engender distress and affect wellness of an individual. The fundamental idea behind screening of thyroid lesion is the detection of neoplasm and differentiating between benign and malignant lesions. An accurate diagnostic tool helps in early detection of these lesions and allows planning of appropriate management with relevant patient counselling [1].

A visible growing lump in the neck is the most common presenting complaint, furthermore the enlarged gland can compress adjacent structures, can also produce multitude of symptoms related to hormonal imbalance and it also carries potential risk of malignancy. Thyroid lesions are more prevalent in females and their predilections remain throughout all age group [2]. Majority of these lesions are benign and only 5% are malignant which require definite surgical intervention [3].

Various diagnostic modalities including Ultrasonogram (USG), Radionucleotide scan, Fine Needle Aspiration Cytology (FNAC) and thyroid function tests are in vogue for the early diagnosis and detection of thyroid lesions. A quest for ease,

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simple and definitive diagnostic tool that would facilitate early diagnosis and treatment especially in malignant lesions has encouraged its great application in the initial evaluation of thyroid. The implementation of the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) has literally revolutionized thyroid FNAC. It became the first line diagnostic tool by introducing a standardized category based reporting and thereby reducing the toll of thyroid surgeries [4,5].

In current scenario, application of FNAC in the preoperative evaluation of thyroid lesion has been widely accepted as one of its most successful achievement. FNAC is considered cost effective, time saving and minimally invasive procedure which carries high rates of sensitivity and specificity. It is acknowledged and recognized as a vital diagnostic tool in the evaluation of thyroid lesions [6].

Acknowledging the significance of FNAC in pre-operative diagnosis of thyroid lesion, the current study was undertaken to classify thyroid swellings according to TBSRTC and to evaluate the diagnostic efficacy of FNAC by correlating with postoperative histopathology findings.

Materials and Methods

This prospective cross-sectional study was conducted in a tertiary hospital, Wayanad, Kerala for over a period of two years from August 2015 to July 2017. Patients presented with palpable thyroid swellings were referred to the department of pathology for performing FNAC. Institutional ethical committee approval was obtained and a total of 710 patients with palpable thyroid swelling were evaluated. Patients who underwent FNAC followed by histopathology were included in the study. Short clinical history was elicited from all patients; other findings including USG and biochemical parameters were recorded.

FNAC was performed in all cases and a preoperative cytological diagnosis was established followed by postoperative histopathological diagnosis. FNAC procedure was performed using a 23-24 gauge needle; the aspirate was smeared on multiple clean dried glass slides and was immediately fixed with alcohol. Staining was done with routine Haematoxylin & Eosin (H&E) and Papanicolaou (Pap) stains. Unfixed smears were air dried and stained with May-Grünwald Giemsa (MGG) *Stain*. Cytological evaluation and diagnosis was done based on TBSRTC.

Excision biopsies of thyroid were immediately introduced in 10% formalin, measurements and weights were noted. Paraffin blocks were prepared after routine histopathology processing techniques. From each block about 3-4 ìm sections were cut, mounted, dewaxed and stained with H&E. Slides were submitted for detailed microscopic examination and the findings were recorded.

Statistical Analysis

Statistical analysis was performed by using IBM Statistical Package for the Social Sciences (SPSS) Software version 21. Statistical methods including Pearson Chi-square test and Fischer Exact test were performed to assess the relationship between different variables. Significance of the statistical tests at P value less than 0.05 was based on 95% confidence interval.

Results

In this study out of 710 cases, 641 (90.3 %) cases were females and 69 (9.7%) cases were males setting up the male female ratio of 1:9.3. Age of the patients ranged from 14 to 81 years with a mean age of 43.94 (SD±12.78). About 45.6% of thyroid lesion were presented in the age group of 41 to 60years and 41.4% were found between age group of 21-40 years. Incidence was low in second (2.2%) and seventh (11.3%) decades of life. Cytological examination unveiled positive malignant rates of 14.5% among males and 8% among females (P=0.06). The mean age of malignancy was 44.2 (SD±7.86) for males and 46.25 (SD±10.99) for females.

Preoperative cytological diagnosis was compared with postoperative histopathological findings. The cytology results were categorized as per recent TBSRT into Benign (category II), Follicular neoplasm (FN)/suspicious of follicular neoplasm (SFN) (category IV), Suspicious of malignancy (SM) (Category V) and malignant category (category VI). In this study 592 (83.4%) cases of non-neoplastic lesions including 575 cases of colloid goitre, 14 cases of thyroiditis and three cases of thyroglossal cyst were classified under category II, 111(15.6%) cases of neoplastic lesions comprising of 50 cases of follicular adenomas and 61 cases of carcinomas were included under Categories IV, V, VI. Aspirates labelled as non - diagnostic/unsatisfactory (category I) and Atypia of undetermined significance or follicular lesions

of undetermined significance (Category III) were not included in the calculation.

Of the 575 cases of colloid goitre, 568 cases (98.78%) showed positive correlation with histopathology, two cases were thyroidits, three cases turned out to be follicular adenoma and two cases proved to be papillary carcinoma thyroid. The accuracy rate of FNAC in diagnosing colloid goitre was found to be 99% [Table 1].

Histopathological examination of all the 50 cases of FN/SFN showed follicular adenoma in 30 cases, follicular carcinoma in nine cases, follicular variant of papillary carcinoma in seven cases and adenomatoid goitre in four cases. Among the sixteen cases diagnosed as suspicious of malignancy (SM) by FNAC, histopathological examination confirmed papillary carcinoma in eight cases, follicular carcinoma in four cases, follicular adenoma in three cases and poorly differentiated carcinoma in one case. All the 45 cases diagnosed as malignant lesions by FNAC were found to be malignant on histopathology. The sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV) and accuracy of FNAC in diagnosing neoplastic lesions were shown in [Table 2]. Pearson chisquare test and fischer exact test showed high level of significance ($p < .001$) between the two methods in diagnosing neoplastic lesions.

Cytological diagnosis was unsatisfactory/non diagnostic in seven cases which were found to be colloid goitre (two cases), thyroiditis (two cases) Follicular adenoma (two Cases) and papillary carcinoma thyroid (one case) on histopathology.

Table 1: FNAC & Histopathology correlation of thyroid lesions

FNAC Diagnosis	HISTOPATHOLOGICAL DIAGNOSIS								
	Colloid Goitre	Thyroidi-tis	Thyroglossal Cyst	Follicular adenoma	Papillary Carcinoma	Follicular Carcinoma	Medullary Carcinoma	Anaplastic Carcinoma	Total
Benign	568	2	0	3	2	0	0	0	575
Colloid Goitre	7	7	0	0	0	0	0	0	14
Thyroiditis	0	0	3	0	0	0	0	0	3
Thyroglossal Cyst									
Non Diagnostic	2	2	0	2	1	0	0	0	7
FN/SFN	4	0	0	30	7	9	0	0	50
SM	0	0	0	3	8	4	0	1	16
Malignant	0	0	0	0	38	0	0	0	38
Papillary CA	0	0	0	0	0	0	3	0	3
Medullary CA	0	0	0	0	0	1		3	4
Other CA	581	11	3	38	56	14	3	4	710

*FN/SFN: Follicular neoplasm/suspicious of follicular neoplasm, *SM: Suspicious of malignancy, *CA: Carcinoma

Table 2: Statistical indices of FNAC in diagnosing Neoplastic thyroid lesions

Statistical indices of FNAC	Diagnosis of Neoplastic thyroid lesions
Sensitivity	95.50%
Specificity	99.32%
PPV	96.4%
NPV	99.15%
Accuracy	98.7%

*PPV: Positive Predictive Value, NPV: Negative Predictive value

Discussion

Thyroid enlargement presents as an evident lump in the neck. It often raises concern but does not always portend hazard. Rather than a dominant nodule, diffuse and symmetrical thyroid enlargement is more likely to be non-neoplastic. Thyroid nodules are seen in 7 -10% of adults and are more prevalent among females. Majority of these lesions are benign and only < 5% is malignant. Prompt and accurate diagnosis of these lesions will help the surgeon to decide the appropriate management [7,8,9].

FNAC remains the mainstay of investigation in the management of thyroid swelling. It carries good sensitivity and specificity with high diagnostic accuracy. The heading factor influencing the accuracy of FNAC is adequacy of sample, which mainly depends on sampling technique and aspirators skill. A sample is considered inadequate if the smears are obscured by haemorrhage or presence of very few follicle cells. In this study smears from 7 cases (<1%) were found inadequate/ non diagnostic which is highly compatible with the other international studies which showed that the rate of non-diagnostic test can go up to 10% [10,11,12,13].

In the present study 14 cases of thyroiditis were diagnosed by FNAC out of which seven cases turned out to be colloid goitre with secondary lymphoid aggregates on histopathology, this was considered as false positive thyroiditis by FNAC. Colloid goitre with significant lymphoid collections might mislead to the diagnosis of thyroiditis on cytology. Hence forth if significant numbers of lymphocytes were seen on smears, USG and biochemical correlations were suggested, if necessary repeated aspiration should be carried out to lower the incidence of false positive cases.

Diagnosis of follicular adenoma, follicular carcinoma and follicular variant of papillary carcinoma by aspiration cytology technique is always a challenge [14]. Though there is uncertainty in the diagnosis of follicular lesions the accuracy rate depends on the competency of pathologist. In our study 16 cases (32%) diagnosed as FN/SFN by FNAC were turned out to be malignant lesions on histopathology. The finding is accordant with the studies done by Baloch ZW et al and Faquin WC et al., which emphasized that about 30% of follicular neoplasm proved to be malignant on histopathology [15,16].

False positivity and false negativity is a major drawback of FNAC. In our study we found that there was no false positive malignancy on FNAC. The sensitivity, specificity, PPV, NPV and accuracy of FNAC in diagnosing malignancy was found to be 78.4%, 90.90%, 95.01%, 65.22%, and 82.24%. Studies done by Kini et al [17] and pinky pandey et al [18] have documented the sensitivity range from 52-98% and specificity range from 72-100%. Haberal AN et al had shown that rate of PPV and NPV can range 50-90% and 63-95% respectively [19]. The present study showed good congruence with the above studies.

False negative rate reveals the proportion of malignancy not diagnosed on FNAC. Many studies have recorded the false negative rate ranging from one to ten percentage [19,20]. The rate of false negativity in our study was found to be 4.5%. Three cases of follicular adenoma were diagnosed as adenomatoid goitre and two cases of papillary carcinoma thyroid were diagnosed as colloid goitre with cystic change on FNAC. Histopathological examination of both these papillary carcinoma thyroid showed cystic change. However in case of cystic nodule adequate sampling is mandatory, if needed USG guided aspiration of solid area to be carried out to lower the false negative rate. The sensitivity, specificity, PPV, NPV and accuracy of FNAC in diagnosing papillary carcinoma thyroid was found to be 82.61%, 100%, 100%, 65.2% and 86.89% respectively. In our study it was found that there was significant increased toll of malignancy among male cases, many other published studies also showed similar findings [21,22,23].

Conclusion

FNAC is an excellent diagnostic tool in the management of thyroid lesions since it provides rapid diagnosis with high accuracy rate. It showed high sensitivity and specificity in diagnosing malignant thyroid lesions. False positive diagnosis rate can be minimized by correlation with usg findings and by taking repeated representative samples.

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Conflict of Interest: No

Key Messages

The key factor which influences the diagnostic accuracy of FNAC is sample adequacy. Our study divulges high malignancy rates among males and significantly low false positive and negative rates.

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