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Original Article

Role of Fine Needle Aspiration Cytology (FNAC) In Evaluation of Thyroid Nodules

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ABSTRACT

Fine-Needle Aspiration Cytology (FNAC) is a practical and low-cost preoperative method for evaluating thyroid gland neoplasms that provides a correct diagnosis fast and with minimal hazards. Thyroid nodules are communal, being existing in up to 50% of the aged populace. The mainstream are benign with thyroid cancer representing an uncommon clinical problem. **Objective:** To assess the role of FNAC of thyroid gland cancers in our environment and the diagnostic performance of the FNAC in identifying these conditions. **Methods:** A retrospective analysis was conducted on 120 individuals who had thyroid swelling when they were first seen and who had surgery between January 2020 and December 2022. Patients with findings from postoperative surgical histopathology and preoperative fine needle aspiration cytology were included in the research. The FNAC's diagnostic accuracy, positive and negative predictive values, sensitivity, and specificity were all calculated. **Results:** Out of 120 patients, 18(15%) were male and 102 (85%) were female. Out of 120 cases, by histopathological examination FNAC showed 79 cases as benign and 41 cases as malignant lesions. **Conclusions:** According to this research, FNAC is a reasonably accurate approach for identifying thyroid gland cancers, with good sensitivity and specificity. Thus, it can be a useful resource for preoperative counselling on the characteristics of the neoplasms and their outcomes as well.

INTRODUCTION

In the general population, 4%–5% of people have thyroid swellings that are clinically noticeable [1]. The majority of these enlargements are benign in origin, with goiter being the most prevalent. More than 40 million people in India and more than 2 billion people worldwide suffer with goiter [2]. Thyroid cancer in nodules is found in people ranging from 0.1% in the general population to 20% in nodules that are surgically biopsied. With an annual incidence of 1-2/100,000, thyroid cancer accounts for 0.5% of cancer-related deaths, 1% of all human cancers and 90% of all endocrine system cancers [3]. Across the world, thyroid nodules are a common clinical issue. Alongside establishing the presence of thyroid nodules and evaluating their size, texture and vascularity, since ultrasound has provided valuable information regarding the qualitative classification of thyroid nodules based on benign or malignant characteristics, it has a wide range of applications. The most sensitive, precise, and economical way to investigate thyroid nodules is through fine needle aspiration cytology [4]. For thyroid nodules bigger than 0.5

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cm and a high-risk history, such as exposure to ionizing radiation as a child or adolescent, or a history of thyroid cancer in one or more first-degree relatives, Fine Needle Aspiration Cytology (FNAC) is recommended., along with a previous hemithyroidectomy where thyroid cancer was found to be suspect based on sonographic features such as micro-calcifications, hypo-echogenicity, enhanced nodular vascularity, infiltrative margins, absence of halo, and taller than wide on transverse view [5, 6]. As the initial diagnostic test for preoperative patient selection in thyroid lesions, FNAC is widely and safely advised. These days, referring physicians can manage patients more effectively thanks to the flexible reporting framework provided by the Bethesda system for reporting thyroid cytology 2007, which offers clinically relevant data [7]. Definitive diagnosis of malignancy, together with the kind of tumors, can be made via thyroid cytology, allowing for one-stage therapeutic surgery. Consequently, in recent years, the incidence of malignancy in thyroidectomy specimens has risen from 5–10% to 30–50%. A nodule with micro calcifications measuring 1 cm or more, a solid nodule measuring 1.5 cm or more with coarse calcifications, and a nodule measuring 2 cm or more with mixed solid and cystic components or connected to abnormal cervical lymph nodes should all undergo FNAC [8]. According to a different research, FNAC has a sensitivity of 84.48% and the corresponding positive and negative predictive values were 78.26%, 90.74% and 66.67% for specificity. Prior to now, thyroid FNAC reporting was complicated by the variety of category definitions. To address this issue, the 2007 Bethesda, Maryland The Bethesda System for reporting Thyroid Cytopathology was developed as a result of the "Thyroid Fine Needle Aspiration State of the Science Conference", which harmonizes nomenclature and morphologic criteria along with the corresponding risk of malignancy [9-11].

Analyzing the diagnostic accuracy of FNAC in the diagnosis of thyroid nodule in our population was the rationale of this study. As large number of populations in Pakistan belongs to poor socio-economic status, mostly diagnostic tool which are available for diagnosis of thyroid nodule are invasive and expensive. FNAC test is comparatively very easy, cheap, and non-invasive and also no hospitalization nor general anesthesia required for the same. In the future, this non-invasive test will be suggested as the first line of investigation to decrease the number of patients who are exposed to biopsy if the results of my study demonstrate that FNAC has good diagnostic accuracy in the detection of thyroid disease for other healthcare professional in future. Additionally, this research will offer a practical and effective clinical tool for early suspect surgical decision-making to prevent delays in diagnosis. To assess the role of FNAC of thyroid gland cancers in current environment and the diagnostic performance of the FNAC in identifying these conditions.

METHODS

This retrospective analysis was conducted in the ENT Head and Neck Surgery Department of the SHED Hospital in Karachi, Pakistan. Using a non-probability consecutive sampling technique, 120 patients who were presented in our department between January 1, 2020, and December 31, 2022, and had both preoperative FNAC and postoperative histopathology results and Patients between 20 years to 75 years of age. The patient had been experiencing thyroid swelling for more than three months. The patient's history, clinical examination, and ultrasound revealed a thyroid nodule with multiple suspicious features, including Extra Thyroidal Extension (ETE), deformed nodular architecture, uneven margins, hypo echogenicity, and micro calcifications (stippled rim calcifications). Only euthyroid patients were selected, assessed by clinically and normal thyroid function test i.e. (TSH level = 0.2-4.00 m IU/l, T3 level = 2.5-5.8pmol/l, T4 level =11.5-23.0pmol/l) were included in this study. Individuals exhibiting diffuse thyroid swelling. Every case of toxic and multinodulargoitres was verified through clinical assessment. Individuals who have previously undergone thyroid surgery of any kind (lobectomy or total thyroidectomy) were excluded from the study. SPSS version 23.0 was used for data analysis and ethical approval of study was obtained from the Supporting Health and Education Deserving fellow (SHED) foundation hospital (00IRB-SH/Approval/2022/050). The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) guidelines have an impact on thyroid cytology diagnosis. All reports should be categorized into one of the following six diagnostic categories: I stand for non-diagnostic or unsatisfactory; II for benign; and III for Atypia of Undetermined Significance (AUS) or Follicular Lesion of Unclear Significance (FLUS). IV: a follicular tumor or any symptoms that point to one; V: a malignancy; VI: a malignant [13]. Utilizing a 5cc or 10cc syringe, a 22-gauge needle was employed to perform FNAC. In the radiology suite, ultrasound guidance was used for all FNAC procedures. In the nodule, at least two passes were made. The specimen that was collected was placed onto a glass slide and treated with either Giemsa or Papanicolaou stain. Diagnostic accuracy, sensitivity, specificity, NPV, PPV were computed.

RESULTS

In this study of 120 subjects there were 18 (15%) males and 102 (85%) were females. Age range was 15 to 75 years old and mean age standard deviation was calculated as 39.83 ± 12.09 years. Majority of the patients belongs to 36-45 years old (31.7%) followed by 26–35 years old (i.e., 36 cases), and the age group of 66–75 years old (i.e., 4 instances) had the fewest patients as indicated in table 1.

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Table 1: Demographic Distribution of the Subjects

Variables	Frequency (%)
Mean ± SD	39.83 ± 12.09
Age (Years)	
15-25	15 (12.5)
26-35	36 (30)
36-45	38 (31.7)
46-55	16 (13.3)
56-65	11 (9.2)
66-75	4 (3.3)
Gender	
Male	18 (15)
Female	102 (85)

Table 2 indicated postoperative histopathology reports of FNAC the results of benign and malignant lesions with Bethesda classification in which majority of cases belongs to class II classification (71) while most of the cases belongs to benign category (79) and 41 are malignant lesions.

Table 2: Post-Operative Histopathology of Thyroid Lesions

FNAC		Histopathological Examination	
Bethesda Classification	Total no. of Cases	Benign N (%)	Malignant N (%)
I	4	4 (100%)	-
II	71	66 (93%)	5 (7%)
III	4	3 (75%)	1 (25%)
IV	5	3 (60%)	2 (40%)
V	25	3 (12%)	22 (88%)
VI	11	-	11 (100%)

Table 3 classified discordant cases (total11) in which most of the cases belongs to papillary carcinoma (36.4%) followed by benign (27.3%) and medullary carcinoma (18.2%) while follicular carcinoma and other carcinomas are up to 9.1% respectively.

Table 3: Details of the Discordant Cases

Bethesda Classification	No. of Cases	Histopathological Result				
		Benign	Papillary Carcinoma	Follicular Carcinoma	Medullary Carcinoma	Other Thyroid Carcinomas
I	0 in 4	-	-	-	-	-
II	5 in 71 (7%)	-	3	1	-	1
III	1 in 4 (25%)	-	-	-	1	-
IV	2 in 5 (40%)	-	1	-	1	-
V	3 in 25 (12%)	3	-	-	-	-
VI	0 in 11	0	-	-	-	-
Total Discordant Cases in 120 Cases	11 (9.16%)	3 (2.5%)	4 (3.33%)	1 (0.83 %)	2 (1.66%)	1 (0.83 %)
% Distribution of Discordant Cases Total 11 Cases	100%	27.3%	36.4%	9.1%	18.2%	9.1%

Table 4 showed the distribution of thyroid cancers found in each Bethesda scoring grade. Out of 41 most of the cases are papillary carcinoma (80.5%), Follicular carcinoma (7.3%), medullary carcinoma (7.3%) and other thyroid carcinomas are (4.9%).

Table 4: Distribution of the Thyroid Cancers

Bethesda Classification	Histopathology Report N (%)			
	Papillary Carcinoma	Follicular Carcinoma	Medullary Carcinoma	Other Thyroid Carcinoma
I	-	-	-	-
II	3	1	-	1
III	-	-	1	-
IV	1	-	1	-
V	21	1	-	-
VI	8	1	1	1
Total from 120 Cases	33 (27.5%)	3 (2.5%)	3 (2.5%)	2 (1.7%)
% Distribution Total no. of Cancers=41	80.5%	7.3%	7.3%	4.9%

DISCUSSION

The primary diagnosis of thyroid swellings was made through an outpatient procedure called Fine Needle Aspiration Cytology (FNAC). The American Thyroid Association and National Comprehensive Cancer Network have established practice guidelines that recommend FNAC as the first diagnostic test before thyroid scintigraphy and ultrasonography due to its higher diagnostic accuracy and cost-effectiveness [12-13]. Since FNAC can distinguish between benign and malignant lesions fairly well, its application has led to a notable drop in the number of surgeries carried out, but it has also increased the number of malignant lesions in patients who have had surgery. Clinically, thyroid nodules are frequently observed, with a reported prevalence of 4-7% in the adult population. Nonetheless, the majority of adult thyroid nodules are benign neoplasms or non-neoplastic lesions, with less than 5% being malignant. Therefore, to avoid needless surgery and potential complications, it is preferable to only operate on patients who have a suspicion of cancer. Nevertheless, the clinical appearance by itself cannot be a reliable indicator of whether these benign lesions are benign or malignant nodules [14]. Today, a variety of imaging methods, including high-resolution ultrasonography and radio nucleotide scanning are utilized to diagnose thyroid nodules. However, FNAC is still thought

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to be the most accurate technique, particularly when ultrasound is utilized as a guide to ensure better sample collection, particularly in cases of cystic lesions [15]. According to published data, the overall accuracy rate of FNAC in detecting thyroid cancer is approximately 95% [15-16]. The identified pitfalls include those involving inadequate specimens, collection methods, the aspiration technique used by the doctor, the pathologist's experience reading the aspirate and the fact that certain benign and malignant thyroid tumors have intermingling cytological characteristics [17]. FNAC has a number of limitations when it comes to diagnosing thyroid nodules, despite its reputation for having high diagnostic accuracy. In 4-21% of cases, inadequate sampling is the cause and indeterminate diagnosis in 3-18% even with the benefit of ultrasound guidance. The best way to manage thyroid nodules is still beset by unresolved issues such as inconclusive diagnosis, inadequate sampling, indeterminate results and potential FNAC misdiagnosis. When done by skilled professionals, ultrasound guided FNAC has a diagnostic sensitivity and specificity of about 83% and 92%, respectively [18]. In our study, the mean age was 39.83 ±12.09 years. The study of Basharat R *et al.*, noted age as 44 years whereas Sharma C, noted as 33.04 ± 12.29 years [19, 20]. In this study, 18 (15%) were male while 102 (85%) were female. Erkinuresin T, reported that 48 cases (16.2%) were male and 248 cases (83.8%) were females. Sharma C noted to have 18% males and 82% females [21]. According to Sharma C, the results of the FNAC were as follows: 80%, 97.7%, 80%, 97.7% and 96% for sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy, respectively [20]. As indicated in a study by Erkinuresin T [21]. The sensitivity of thyroid FNAC for malignant cases was 57.89%, specificity was 88.10%, false-positive rate was 11.90%, false-negative rate was 42.11%, positive predictive value was 52.38%, negative predictive value was 90.24% and accuracy rate was 82.52%.

CONCLUSIONS

FNAC detects both benign and malignant thyroid lesions with excellent sensitivity and specificity, it should be performed in all thyroid nodule cases. Facility of cytopathological diagnosis of thyroid disease should also be available in all secondary and tertiary health centers. This strategy is both dependable and economical in detecting malignant thyroid gland tumors and provides the surgeon with valuable information in preoperative diagnostics.

Authors Contribution

Conceptualization: MMUK

Methodology: SFA

Formal analysis: MWUK

Writing, review and editing: MWUK, SFA, TGA, SS, AAA

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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