Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v31i7.6926

PREDICTIVE VALUE OF FINE NEEDLE ASPIRATION CYTOLOGY VERSUS ULTRASOUND TI-RADS IN SOLITARY THYROID NODULE COMPARING WITH GOLD STANDARD

Shah Nawaz Khatti[1*], Imtiaz Ali Soomro[2], Muhammad Ghazi Asad Khan[3], Imtiaz Ali Langah[4], Ahmed Hussain Pathan[5], Rizwan Ali[6]

[1*]Assistant Professor General Surgery, Liaquat University of Medical and Health Sciences Jamshoro Pakistan. email: drkhatti786@gmail.com (Corresponding author)
[2]Assistant Professor General Surgery, Peoples University of Medical and Health Sciences Nawabshah Pakistan. email: Pumhsimtiazsoomro@gmail.com
[3]Graduate, Liaquat University of Medical and Health Sciences Jamshoro Pakistan. email: ghaziasad9001@gmail.com
[4]Assistant Professor General Surgery, Peoples University of Medical and Health Sciences Nawabshah Pakistan. email: langahimtiaznova@gmail.com
[5]Associate Professor General Surgery, Liaquat University of Medical and Health Sciences Jamshoro Pakistan. email: dr.ahmedhussain@outlook.com
[6]Medical Officer, Liaquat University Hospital Hyderabad/Jamshoro Pakistan. email: mahesar.alirizwan@gmail.com

***Corresponding Author:** Shah Nawaz Khatti
*Assistant Professor General Surgery, Liaquat University of Medical and Health Sciences Jamshoro Pakistan. email: drkhatti786@gmail.com

ABSTRACT

Background: Thyroid nodule characteristics are evaluated by ultrasound, which helps direct further investigation or treatment. Fine needle aspiration cytology (FNAC) is used for diagnosis when required. Thyroid carcinoma is the most common endocrine cancer, although being extremely rare. By 2030, it is expected to rise to the fourth rank of all cancers in the US. In the US, its yearly incidence has increased by 500%. Thyroid cancer is more common in women and has a very variable prevalence by geographic area. There has been rise in thyroid cancer cases in Pakistan.

Objective: To assess the predictive efficacy of FNAC and ultrasonography TI-RADS in the evaluation of single thyroid nodules.

Study design: Cross-sectional study

Place and Duration: This study was conducted in Liaquat University of Medical and Health Sciences Jamshoro from March 2023 to March 2024

Methodology: All the participants of this research were aged 18 years and above. All of the participants were having thyroid nodules and their informed consent was obtained. Details were kept of the patient's residence, gender, age, comorbidities, and history of thyroid illness, among other demographic and clinical details. Thyroid function tests (serum TSH and free T4) were performed on participants with thyroid nodules utilizing the CLIA 1000 analyzer. The study sample consisted solely of euthyroid patients who underwent fine needle aspiration cytology (FNAC) and high-resolution

ultrasonography. IBM SPSS version 25 was used for the statistical analysis, which included the Fisher exact test and the Chi-square test.
Results: There were a total of 300 participants involved in this research. The average age was 41.7 years. Most of the participants were from the age group of 40 years to 60 years. Majority of the participants were females, representing 68% of the total population.
Conclusion: In conclusion, when assessing euthyroid patients with isolated thyroid nodules, ultrasonography is a useful adjunct to FNAC.

Keywords: Thyroid nodules, euthyroid, FNAC, Ultrasound

INTRODUCTION

Thyroid nodule characteristics are evaluated by ultrasound, which helps direct further investigation or treatment [1, 2, 3]. Fine needle aspiration cytology is used for diagnostics when required [4]. Thyroid carcinoma is the most common endocrine cancer, although being extremely rare [5]. By 2030, it is expected to rise to the fourth rank of all cancers in the US [6]. In the US, its yearly incidence has increased by 500% [7]. According to the Cancer Statistics Centre, there were 43,800 new cases of thyroid cancer recorded by the American Cancer Society in 2022, or an incidence rate of 14.1 per 100,000 [8].
Thyroid cancer is more common in women and has a very variable prevalence by geographic area. There has been rise in thyroid cancer cases in Pakistan [9]. However, it is difficult to ascertain the current incidence rates of thyroid cancer in Pakistan because epidemiological research and population-based surveys are few. A survey found that the ratio of men to women was 4.7:1 [10]. There has no recent epidemiological investigation done in Pakistan.

The Thyroid Imaging, Reporting, and Data System (TI-RADS) creates a common language for characterizing thyroid nodules and offers treatment suggestions according to the particulars of the detected lesion [11]. Fine needle aspiration cytology (FNAC) operations that are not essential are reduced when ultrasonography reporting is done using TI-RADS [12].

METHODOLOGY

The Ethical Review Committee approved this study. All the participants of this research were aged 18 years and above. All of the participants were having thyroid nodules and their informed consent was obtained. A sample size of 300 was calculated using an internet calculator based on a 95% confidence level, 0.10 accuracy, and 0.18 prevalence of solitary thyroid nodules. Convenience sampling with non-probability was used.

Exclusion criteria: Since pediatric surgeons treat children and adolescents, they were excluded from the study.
Details were kept of the patient's residence, gender, age, comorbidities, and history of thyroid illness, among other demographic and clinical details. Thyroid function tests (serum TSH and free T4) were performed on participants with thyroid nodules utilizing the CLIA 1000 analyzer. The study sample consisted solely of euthyroid patients who underwent fine needle aspiration cytology (FNAC) and high-resolution ultrasonography. While FNAC data were classified using the Bethesda system, ultrasound reports were scored using the TI-RADS scoring system (1–5). The gold standard, histopathology, was done on each patient.
IBM SPSS version 25 was used for the statistical analysis, which included the Fisher exact test and the Chi-square test. For ultrasound markers that indicate malignancy, the following metrics were calculated: sensitivity, specificity, negative predictive value (NPV), positive predictive value (PPV), and NPV. The probability of malignancy in each TI-RADS and Bethesda category was calculated using odds ratios (OR) with 95% confidence intervals in relation to the findings of histopathology.

RESULTS

There were a total of 300 participants involved in this research. The average age was 41.7 years. Most of the participants were from the age group of 40 to 60 years. Majority of the participants were females, representing 68% of the total population. Table number 1 shows the demographics of the participants of this research.

Table No. 1: demographics of the participants (n=300)

Demographics	n	%
Gender		
Male	96	32
Female	204	68
Age (Years)		
18 to 40	111	37
41 to 60	177	59
Above 60	12	4
Presenting symptoms		
Difficulty in swallowing	39	13
Neck Pain	33	11
Neck Swelling	108	36
Fever	21	7
Warm skin	18	6
Changes of voice	21	7
Excessive sweating	60	20

Table number 2 shows the cytological, clinical, histopathological, and radiological features.

Table No. 2: cytological, clinical, histopathological, and radiological features

Demographics	n	%
TI-RADS		
Malignant	264	88
Benign	36	12
TI-RADS Score		
TI-RADS 1	30	10

TI-RADS 2	6	2
TI-RADS 3	90	30
TI-RADS 4	138	46
TI-RADS 5	36	12
Biopsy report		
Malignant	225	75
Benign	75	25
FNAC report		
Malignant	276	92
Benign	24	8

Table number 3 shows the results of FNAC vs Ultrasound TI-RADS compared with the final histopathology report.

Table No. 3: the results of FNAC vs Ultrasound TI-RADS compared with the final histopathology report.

Comparison	**Histopathology report**			
	Malignant		**Benign**	
	n	**%**	**n**	**%**
TI-RADS				
Malignant	3	1	36	12
Benign	42	14	219	73
FNAC report				
Malignant	18	6	6	2
Benign	57	19	219	73

DISCUSSION

Precisely identifying thyroid nodules is essential to prevent needless surgeries and for prompt interventions [13, 14]. This study illustrated the usefulness of diagnostic tools in helping physicians, to manage patients with solitary thyroid nodules that is an extremely difficult patient condition [15]. Thyroid nodules are frequently diagnosed with FNAC and TI-RADS, although there is ongoing discussion on their reliability [16]. This study adds data supported by evidence to the conversation.

The demographic profile of the study participants was diversified, exhibiting a range of traits. The gender and age distribution figures in this study are consistent with previous research, showing that women made up 68% of the overall population under study [17].

TI-RADS 4 was the most common category, followed by TI-RADS 3, according to the 2017 ACR TI-RADS criteria, suggesting a primarily benign pattern. Using the Bethesda classification,

cytopathology investigations revealed that the most common group was Bethesda 2. Both FNAC and TI-RADS showed noticeably greater percentages of benign cases when compared to histology reports and FNAC and histopathology reports. While FNAC's high sensitivity was in line with previous research, its lower specificity suggests that thyroid nodules can be successfully detected with a significant number of false positives. TI-RADS demonstrated a high sensitivity of 98.88%, suggesting its value in conjunction with FNAC for a comprehensive diagnostic strategy, although being slightly more specific.

In order to improve patient care, this study alerts doctors to the correlations between biopsy results and cytopathology across several TI-RADS categories. This underscores the necessity of an all-encompassing diagnostic approach. It implies that thyroid nodules can be detected with high sensitivity using both FNAC and TI-RADS, with TI-RADS exhibiting somewhat higher specificity. FNAC is sensitive, but its specificity is limited, which increases the number of false positives. As an additional radiological technique to help determine whether nodules are benign or malignant, TI-RADS complements FNAC. As reported in the literature, these combined results provide clinicians with useful assistance when deciding whether to pursue additional management for thyroid nodules [18, 19].

Recognizing the use of histopathology as the gold standard for assessing the precision of diagnostic techniques—particularly FNAC—is crucial [20]. When pathologists examine the same tissue sample, subjective evaluations of cellular characteristics, patterns, and structures can lead to differences in conclusions. The application of ultrasound TI-RADS varies due to factors such as operator expertise and device sensitivity. The experience of the radiologist may have an impact on the accuracy of the diagnosis, and many imaging modalities have been studied in the literature.

CONCLUSION

In conclusion, when assessing euthyroid patients with isolated thyroid nodules, ultrasonography is a useful adjunct to FNAC. When it comes to nodule detection, FNAC and TI-RADS both have excellent sensitivity, while TI-RADS has somewhat greater specificity.

Funding source

This study was conducted without receiving financial support from any external source.

Conflict in the interest

The authors had no conflict related to the interest in the execution of this study.

Permission

Prior to initiating the study, approval from the ethical committee was obtained to ensure adherence to ethical standards and guidelines.

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