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DIAGNOSTIC PRECISION RATE OF ULTRASONOGRAPHY AND FINE-NEEDLE-ASPIRATION CYTOLOGY FOR THE PREDICTION OF BENIGN THYROID LESIONS

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ABSTRACT

Objective: The abnormal development of the thyroid glands is thyroid nodules that is the cause of formation of mass inside the thyroid gland. TNs (Thyroid Nodules) are much common and significance lies in the requirement to exclude the thyroid cancer. The objective of this research work was to assess the diagnostic preciseness of the ultrasonography in comparison with the FNA (Fine Needle Aspiration) cytology to differentiate the benign thyroid abrasions from malignant thyroid lesions. **Methodology:** 133 patients were present with thyroid abrasions. All the patients had to undergo ultrasonography and Fine-needle-aspiration cytology. We compared the results of both examinations. **Results:** The average age of the patients of this research work was 41.20±15.0 years and 85.0% (n: 113) patients were females. There were benign thyroid abrasions in 94.70% (n: 126) patients and thyroid lesions were malignant in 5.30% (n: 9) patients. Among 124 patients with benign thyroid abrasions diagnosed with ultrasonography, 98.38% (n: 122) patients got confirm diagnosis with use of FNA cytology and there was presence of malignancy in only1.60% (n: 2) patients. Among total 9 patients present with malignant thyroid lesions as diagnosed with US, Fine-needle-aspiration cytology confirmed 5 patients with malignancy and 4 patients were present with benign thyroid abrasions. US identified the BTL (Benign Thyroid Lesions) with sensitivity, specificity, PPV (Positive Predictive Value) and NPV (Negative Predictive Value) of 98.380%, 71.420%, 98.380%, and 55.550% correspondingly. The finding showed the positivity between diagnosis of BTL by US and confirmed diagnosis with the use of Fine-needle-aspiration cytology (P<0.0010). **Conclusion:** A much valuable tool to differentiate the BTL from the MTL is B-mode ultrasonography. It helps in the prediction of the benign nature of thyroid abrasions with excellent preciseness in diagnosis.

KEYWORDS: Benign Thyroid Lesions, Ultrasonography, Fine-Needle-Aspiration, Comparison.

INTRODUCTION

The abnormal developments of the thyroid cells which is the cause of formation of mass in the thyroid glands are TNs (Thyroid Nodules). Thyroid Nodules are much common and they are present in 20.0% to 76.0% of general population.[1] The incidence of Thyroid Nodules has been reported as 2.0% to 6.0% with palpation, 19.0% to 35.0% with US, and 8.0% to 65.0% on autopsy.[2] The rate of prevalence of TNs is much high in the females as compared to males and its incidence increases with the increase in age.[3] There is occurrence of thyroid cancer in 7.0% to 15.0% patients.[4] No-modifiable risk factors are the female gender, elder age and history of radiation exposure to neck. Deficiency of iodine, alcoholic abuse and habit of cigarette smoking are some modifiable risk factors.[5] Some of the benign TNs are colloid nodules, adenomatous nodules and cystic nodules.[6] First line imaging modality utilized to characterize and identify Thyroid Nodules is US. GSU (Gray Scale Ultrasonography) imaging features are much reliable for differentiating the benign nodules form malignant nodules.[7] TN's elastic properties displayed the malignant nodules as stiffer as compared to benign nodules and this factor leads to high accuracy rate with the use of GSU.[8] Depending upon the sonographic patterns, EU-TIRADS [European Thyroid Imaging Reporting & DataSystem] determined the malignancy risk in various categories of thyroid
abrasions as follows;
Category-1 No risk
Category-2 Thyroid with pure cyst
Category-3 Low risk (2.0 to 4.0%) i.e. ovoid isoechoic nodules with flat margins
Category-4 Intermediate risk (6.0% to 17.0%) i.e. ovoid, hypoechoic nodules with flat margins
Category-5 High risk (26.0% to 87.0%) i.e. nodules with highly-suspicious features.[9] BTA (British Thyroid Association) categorized

TNs into 5 classes

U1	Normal thyroid gland
U2	Benign TN
U3	Intermediate
U4	Suspicious TN
U5	Malignant TN.[10]

Gold standard for the differentiation of TNs is FNA cytology. False negative rate for the FNA biopsy is 1.0% to 3.0% and rises to 10.0% to 15.0% for nodules greater than 4.0cm.[9] This research work carried out to highlights the accuracy of diagnostic of US for BTL as compared to the FNA cytology.

METHODOLOGY

We conducted this research work at Jinnah Hospital Lahore. This study involved the reports electronically generated of ultrasonography as well as of FNA cytology of 133 patients who had to undergo thyroid ultrasonography and (US-guided) FNA-cytology from June 2018 to August 2020. We selected all the patients for FNA cytology with the utilization of the instructions of ATA (American Thyroid Association) of 2015.[10] On the basis of BTA US classification [U1-U5] thyroid nodules, this research work included the patients present with lesions of U3, U4 & U5. We excluded the patients present with the U1 or/and U2 abrasions. All the patients had to undergo ultrasonography by a single well experienced radiologist. Same US machine was in use for all the patients. A 7.50 or 10.0 MHz linear transducer was in use for the evaluation of thyroid abrasions.

After evaluation by US, FNA cytology was carried out on thyroid nodules of 133 patients by the single radiologist. FNA was carried out with the use of 23-Guage needle attached to a 10.0ml disposable syringe made up of plastic with no local anesthesia.

The target of FNA were the solid nodule's part. The samples of the aspiration biopsy were expelled and then we smeared them on the slides of glass. For every patient, 6 to 9 slides fixed in 95.0% of ethanol were sent for examination to pathologist. Only one high experienced pathologist examined all the patients. The reports of cytopathology classified the findings as malignant, benign, inadequate, indeterminate and suspicious for malignancy. Inclusion standard involved the FNA cytology findings categorized as benign only, or malignant or suspicious for the malignancy. We excluded the patients without results of FNA cytology and patients with indeterminate findings on FNA cytology or present with inadequate specimens.

Ethical committee of the institute gave the permission to conduct this research work. We obtained the written consent from every patient before the use of FNA cytology. We ensured the confidentiality in collection of the data. SPSS V.23 was in use for the statistical analysis of the collected information. We expressed the descriptive data in frequencies. We used the Chi square method for the comparison of categorical variables and we also calculated the OR (Odd Ratios). We also calculated the PPV, NPV, sensitivity and specificity for US.

RESULTS

There were 133 patients in this research work in which 113 were females and 20 were males. The range of the age of these patients was 10 to 80 years with an average age of 41.20 ±15.0 years (Table-1).

Table I: Demographic Data of the Patients.

Gender	No	Percentage	p value
Male	20	15	<0.001
Female	113	85	
Decades of the patients			
1-10 years	2	1.5	<0.001
11-20 years	10	7.5	
21-30 years	27	20.3	
31-40 years	36	27.1	
41-50 years	31	23.3	
51-60 years	13	9.8	
61-70 years	10	7.5	
71-80 years	4	3	
Total	133	100	

126 (94.70%) patients were present with BTL (Benign Thyroid Lesions) and seven (5.30%) patients were present with MTL (Malignant Thyroid Lesions). There was diagnosis of BTL in 106 (84.10%) female patients and 20 (15.90%) male patients. Among 124 patients with BTL identified with US, 122 (98.380%) patients were confirm patients of benign diagnosed with FNA cytology and only 1.60% (n: 2) patients were discovered as malignant. Among 9 patients present with MTL with US, FNA cytology confirmed the malignancy in five (55.60%) patients and among them 4 (44.40%) patients were suffering from disease of benign nature (Table-2).

Table II: Diagnosis by US (Rows) vs. Diagnosis by FNA Cytology (Columns).

Diagnosis by Ultrasonography	FNA cytology diagnosis		
	Benign	Malignant	Total
Benign	122 (98.38%)	2 (1.6%)	124 (100%)
Malignant	4 (44.4%)	5 (55.6%)	9 (100%)
Total	126 (94.7%)	7 (5.3%)	133 (100%)

Commonest benign diagnoses were MNG (Multi-Nodular Goiter) (36.80%), followed by the CN (Colloid Nodules) (20.30%) (Table-3). Overall rate of sensitivity of US to diagnose the BTL was 98.380%, with a specificity of 71.420%, PPV as 98.380% and NPV as 55.550%.

Table III: Cross Tabulation Between Primary US-Diagnosis (Columns) and FNAC-Diagnosis (Rows).

			US Diagnosis					
FNA diagnosis	**Colloid nodule**	**Adenomatous nodule**	**Cystic lesion**	**Goiter**	**Thyroiditis**	**Carcinoma**	**Not determined**	**Total**
Colloid nodule	17 (47.2%)	4 (11.1%)	6 (16.7%)	0 (0.0%)	0 (0.0%)	1 (2.8%)	8 (22.2%)	36 (100.0%)
Adenomatous nodule	3 (12.5%)	13 (54.2%)	0 (0.0%)	3 (12.5%)	0 (0.0%)	2 (8.3%)	3(12.5%)	24 (100.0%)
Goiter	6 (10.3%)	0 (0.0%)	1 (1.7%)	44 (75.9%)	4 (6.9%)	0 (0.0%)	3 (5.2%)	58 (100.0%
Thyroiditis	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (28.6%)	5 (71.4%)	0 (0.0%)	0 (0.0%)	7 (100.0%)
Carcinoma	1 (14.3%)	11 (14.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (57.1%)	1 (14.3%)	7 (100.0%)
Hemangioma	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100.0%)	1 (100.0%)
Total	27 (20.3%)	18 (13.5%)	7 (5.3%)	49 (36.8%)	9 (6.8%)	7 (5.3%)	16 d (12.0%)	133 (100.0%)

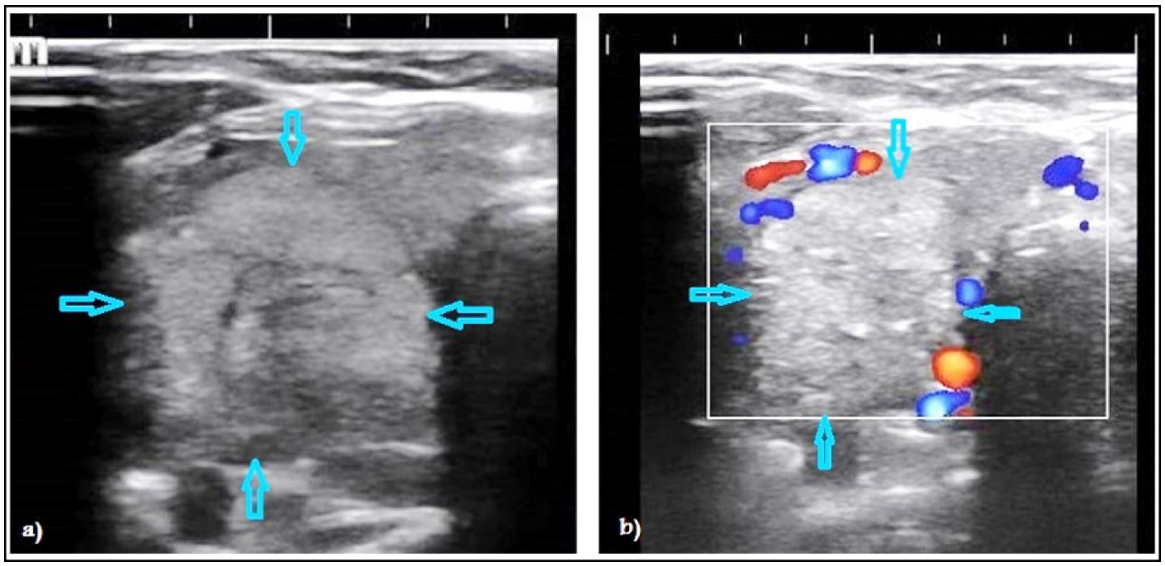

Figure 1

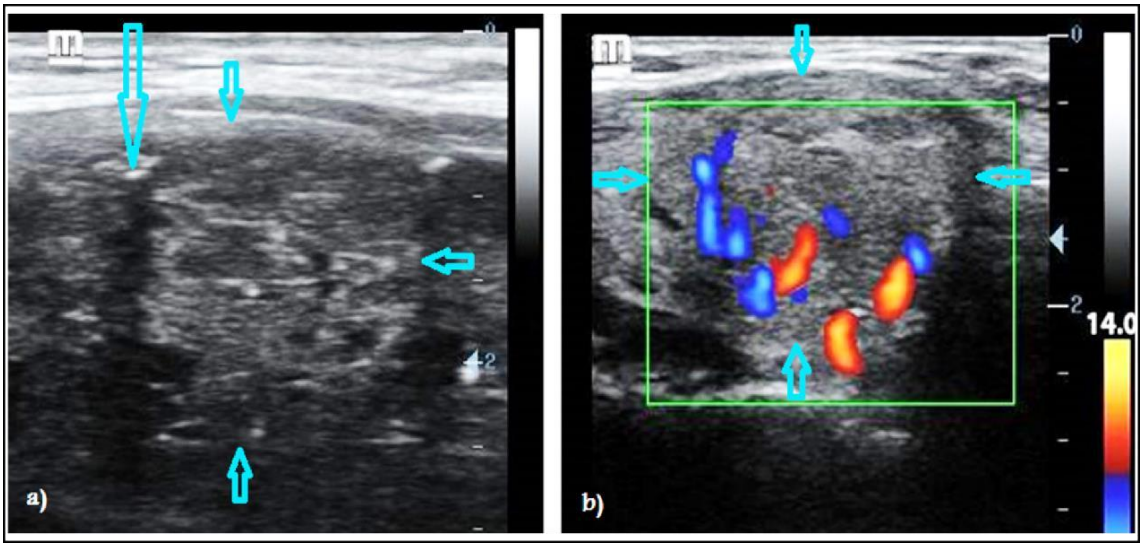

Figure 2

DISCUSSION

There are various methods for the diagnosis of the Thyroid Nodules. The significance lies in the significance to separate thyroid cancer.[11] The most important diagnostic imaging tool in preoperative detection of Thyroid Nodules is B-mode ultrasonography. A gold standard for the assessment of Thyroid Nodules is FNA cytology.[12] In this research work, we discovered that more females patients got this complication as compared to the male patients (85.0% vs 15.0%), these findings are similar with the results of other research work conducted in past by Saeed MI, Richman DM, Ram N and Germano A who reported the rates of lesions in the female patients of 87.30%, 82.80%, 80.0% and 79.0% correspondingly.[13] The findings were also consistent with the results of the research work conducted by Dalia who stated that the presence of Thyroid Nodules in female patients is 4 times greater as compared to male patients.[14] The reason of this high incidence in the females may be due to the contribution of estrogen &progesterone may.[15] In opposite, Chen Y reported that there is high incidence of Thyroid Nodules in the male population of China.[16] In this research study, average age of the patients was 41.20 ±15.0 years. This finding is also consistent with the past research works conducted by Cesur M & Ramwho stated an average age of 43.0±9.40 and43.0±13.0 years, respectively.[17]

In this current research work, US diagnosed the thyroid lesions of benign nature in 98.40%, with only 1.60% patients as falsepositives. These findings are also consistent with the study conducted by Persichetti A who stated the rate of malignancyof 2.80% among thyroid lesions of benign nature.[18] This research work showed the sensitivity of US as 98.38% in the determination of the nature of thyroid lesions. PPV was 98.38% and NPV was 55.55% for the BTL with specificity as 71.42%. US has the ability to diagnose the MNG, thyroid carcinoma and thyroiditis in 75.90%, 57.10% and 71.40% patients respectively.[19] These findings are much consistent with the research work of Manikantan G who stated that US is much effective in the determination of the thyroid lesion's nature with a rate of accuracy of about 84.5%. These findings are consistent with the results of a research work conducted by Popli MB who stated 87.20% accuracy of diagnosis with the use of US for the detection of BTL and MTL.

Alam T stated that overall diagnostic precision of US was 82.0% to diagnose MTL. Li W stated the eighty four percent accuracy, specificity and sensitivity for US. The findings of this research work also confirmed these results.[20] One research work of Brito JP conducted in past stated that spongiform appearances on the US have the ability to predict the benign TNs, while features of the US imaging are not precise predictors of the thyroid lesions. In this current research work, commonest thyroid abrasions were CN, MNG, thyroiditis and adenomatous nodules.[21] This finding was much consistent with the findings of research work conducted by Qureshi IA who stated that 76.10% of non-neoplastic abrasions were MNG.

CONCLUSION

The most valuable tool to differentiate the benign thyroid lesions from the malignant thyroid abrasions is B-mode ultrasonography. It has the ability to predict the benignthyroid lesions with much high specificity and sensitivity of diagnosis.

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