Original Article

DIFFERENTIATION OF SOLID THYROID NODULES USING HIGH FREQUENCY ULTRASOUND AND CORRELATION WITH HISTOPATHOLOGY

Shama Aslam[1], Murtaza Ali[2], Nosheen Ahmad[3], Samina Jabeen[4]
[1]Assistant Professor Radiology, Allied Hospital ,Faisalabad.
[2]Senior Registrar Orthopaedics, Allied Hospital, Faisalabad.
[3]Assistant Professor Radiology, Allied Hospital, Faisalabad.
[4]Woman Medical Officer Radiology, Madinah Teaching Hospital, Faisalabad.

ABSTRACT:

OBJECTIVE: Aim of my study is to determine the diagnostic accuracy of ultrasound (US) classification system for differentiation of solid thyroid nodules whether they are benign or malignant.

MATERIALS AND METHODS: We enrolled 191 patients who underwent real-time US neck and found to have solid thyroid nodules followed by fine-needle aspiration cytology of nodules. Real time USG was used to classify thyroid nodules into 1 of 5 diagnostic categories: Malignant, suspicious for malignant lesion, borderline categories, probably benign lesions and benign categories. We found the diagnostic accuracy of thyroid nodules characteristics with the histopathological results.

RESULTS: Out of the 96 solid thyroid nodules, 89 underwent thyroid surgery. According to US characteristics for these 96 nodules we categorize as malignant (n = 26), suspected for malignancy (n = 8), borderline lesion (n = 12), probably benign (n = 8), and benign (n = 41). We apply receiver-operating characteristic curve analysis which shows that when we use US for the diagnosis of solid thyroid nodules, as we use 5 categories of USG neck for US classification system. The sensitivity 86%, specificity 95%, PPV 91%, NPV 92%, and found high diagnostic accuracy i.e. 92%, when benign, probably benign, and borderline categories were collectively classified as benign entity.

CONCLUSION: The thyroid US having high diagnostic accuracy for solid thyroid nodules especially when we use the 5 category US classification system.

KEYWORDS: Thyroid nodule, thyroid ultrasound, fine-needle aspiration cytology.

INTRODUCTION:

Thyroid ultrasound (US) is the 1st line of investigation for diagnosis of thyroid nodules. The widespread use of thyroid ultrasound has high role for the thyroid nodules risk stratification[1]. Management of thyroid nodules is influenced by high resolution USG of neck; indeed, currently USG of neck is used not only as a first-line diagnostic tool but for guidance of fine needle aspiration cytology (FNAC) and post-operative follow-up imaging[2]. Although thyroid nodules may be detected at other modalities as computed tomography (CT scan) and magnetic resonance imaging (MRI), but these are not good for nodular characterization. Positron emission tomography (PET) is also a good tool for identification of thyroid nodules, but it is also having limited role in differentiation of benign from malignant lesions[3]. On high resolution, certain USG features, such as

Corresponding Author:
Shama Aslam
Assistant Professor Radiology, Allied Hospital, Faisalabad.
E.mail: meshamaaslam@hotmail.com

hypoechoic texture, irregular or ill defined margins, non shadowing microcalcifications, have been used as potential markers for the presence of malignant thyroid lesions[4].

High resolution USG has high sensitivity for the detection of incidental thyroid nodules, which sometimes result in over diagnosis of these asymptomatic cases[5,6].

The aim of our study is to determine the accuracy of USG for the diagnosis of benign and malignant solid thyroid nodules with high resolution real-time USG performance and to classify them using 5 categories.

MATERIAL & METHODS:

The study was conducted in Madina Teaching Hospital Faisalabad. Duration of study was six months from July 2013 to December 2013. Permission was sought from hospital ethical committee. Patients are collected from OPD of Radiology Department of Madina Teaching Hospital Faisalabad. 96 patients were included in study. Inclusion criterion was patients with solid thyroid nodules (any number of nodules) having a minimum diameter of >5mm who underwent FNAC of lesions were included in the study. Exclusion criteria was patients who refuse to enrol in the study, from FNAC or thyroid surgery. Histopathology was taken as gold standard diagnosis.

On US, malignancy was considered if thyroid nodule having certain characteristics as hypoechoic texture, irregular/ill defined margins, non shadowing microcalcifications, nodules which are taller than wide, and cervical lymphadenopathy with intranodal cystic components or microcalcifications.

Benign lesions having characteristics of being an oval or flat disc shape, isoechoic texture, smooth/ well defined margins, and peripherally increased vascularity.

The criteria for categorization of thyroid nodules was as follows; if a thyroid nodule having two or more US characteristics for malignancy it was considered as malignant; if only one feature for malignancy was found, it was considered as being suspicious for malignancy; if a nodule having borderline USG characteristics (one or more) without malignant features it was thought to be borderline; if one or two benign USG features were found but no malignant features, it was considered as probably benign; if three or more USG characteristics of a benign nodule was found with no malignancy it was considered as benign lesion. All thyroid nodules were assessed on Toshiba NEMIO using high resolution linear probe. US-guided fine-needle aspiration was performed for a single nodule having diameter of 5-10mm, in case of multiple nodules FNAC of 4 suspicious looking nodules were taken while in case of benign looking nodules FNAC of largest nodule was done and was sent to the department of pathology for cytopathological results.

We compared US diagnoses with histopathological results. Thyroid nodules were classified as malignant which are having malignant and suspicious for malignant features and benign were classified as having benign and borderline benign features.

Statistical Analysis

For thyroid nodules we calculate sensitivity, specificity, PPV, NPV and diagnostic accuracy using USG. Receiver-operating characteristic (ROC) was used to find out highest diagnostic accuracy using 5 categories of thyroid nodules on USG. To evaluate cut-off US criteria for thyroid malignancy the areas under the ROC curve (Az) were determined. 95% confidence interval was taken as statistically significant differences between Az values using SPSS software. *P* values less than 5% were taken to be statistically significant.

RESULTS:

We perform high resolution USG of 96 patients (M:F = 21:75; mean age, 40.0 years), thyroid nodules were classified as: malignant nodules (n = 26), suspicious lesion for malignancy (n = 8), borderline malignancy (n =12), probably benign lesions (n = 9), and benign nodules (n = 41). FNAC of the nodules are taken and Histopathological results of 96 patients are detailed in table 1.

Table 1: USG * histopathology Cross tabulation

USG		histopathology		Total
		malignant	benign	
USG	malignant	26	0	26
	suspicious for - malignancy	5	3	8
	borderline malignant	2	10	12
	probably benign	2	7	9
	benign	1	40	41
Total		36	60	96

The nodules (n = 41) assigned to the benign US category and benign cytology were followed up with US examination after at least 12 months; a significant interval change, such as new detection of suspicious US features or significant increase in nodular size (50% or more increase in nodular volume) was not found. Out of the 96 patients, 22 were having only one thyroid nodule while 74 patients were having two or more thyroid nodules.

When we use ROC analysis, the diagnostic accuracy of US diagnosis was highest when USG categories of malignant and suspicious for malignancy were classified as malignant on FNAC and other USG categories were taken as benign. The sensitivity, specificity, NPV, PPV and diagnostic accuracy of thyroid US for differentiating a malignant lesion from a benign one were as follows as in table 2: Diagnostic indices for individual US categories are shown in Table 2 & 3.

The US categories for the diagnosis of malignant and benign resulted in a high predictive value; 100% positive predictive value for malignant, 86% negative predictive value for malignant, and 96% positive predictive value for benign. However, the suspicious for malignancy US category yielded a relatively low diagnostic accuracy value.

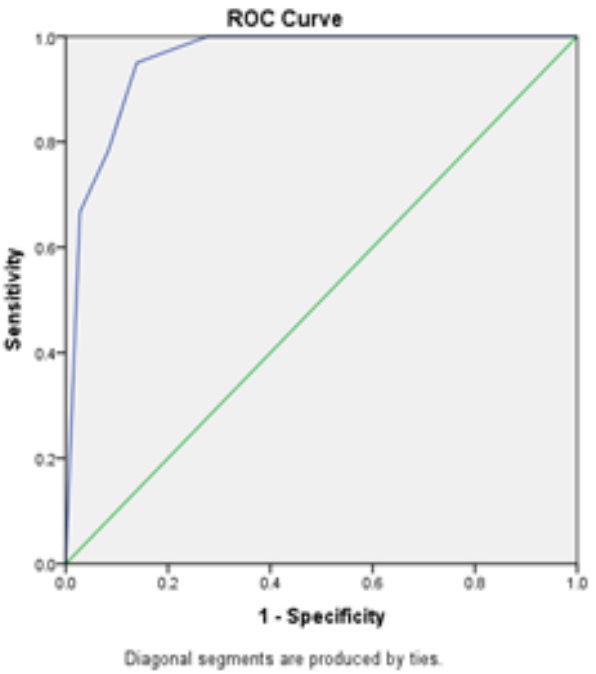
The cut-off US criteria applied for thyroid malignancy were significant for ROC analysis. When we take malignant lesions as nodules having two or more malignant USG features, the Az (test of statistical significance) value was found to be 0.950, which is the highest among Az values. An ROC analysis revealed that the diagnostic accuracy of thyroid US using the present US classification system was very good (z = 0.950)

Table 2

	Sensitivity(%)	Specificity(%)
Malignant	72	100
Suspicious for malignancy	14	95
Borderline	16	64
Probably benign	11	95
Benign	66	96

Table 3

	PPV (%)	NPV (%)	Diagnostic accuracy(%)
Malignant	100	86	90
Suspicious malignancy	63	65	64
Borderline	83	41	46
Probably benign	80	41	42
Benign	96	43	78



Area Under the Curve

Test Result Variable(s): USG

Area	Std. Error	Asymptotic Sig.	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.955	.023	.000	.910	1.000

DISCUSSION:

According to the study in United States, thyroid cancer incidence is 37,000 per year and in over last 30 years this incidence has doubled. This is mainly due to an increased use of imaging modalities for work up of incidentalomas[7].

High-resolution ultrasound has resulted in our ability to detect thyroid nodules in at least 50% of the general adult population, compared with a detection rate of 4–8% by traditional clinicalpalpation[8].

CT and MRI can detect thyroid incidentalomas (ITNs), approximately rate of these ITNs are up to 1 in 6 CT Scans of neck[9,10]. But the problem with cross sectional imaging is their inability to characterize these nodules as there are no markers to label them as benign or malignant unless they show aggressive behaviour[11]. Studies are going on to find the value of DWI in characterization of these incidentalomas but still the preferred modality for work-up is high resolution USG of neck[12].

So we use 5 categories to characterize the nodules on USG neck and correlating with Histopathological results in either benign or malignant lesion we found high accuracy of thyroid USG using present classification system.

If we compare with the study by Kim et al.[13] the diagnostic accuracy of thyroid USG is greater in our study.

Different sets of guidelines have been published to help in the management of the large number of these thyroid nodules[14]. Guidelines of The latest American Thyroid Association recommend that in patients at high risk of malignancy FNAC should be done if nodules having diameter of >5mm and in rest of patients correlating with USG features, FNAC is advised if nodule size is greater than 1 to 1.5 cm[15].

In a study by OzlemUnsal, he found that the diagnostic accuracy of US in suspicious looking thyroid nodules was 80.2% with Az value of 0.675[16].

In study by Horvath et al.[17], they found that an ultrasound of neck is highly effective not only in helping patient management but also a highly cost-effective tool as unnecessary FNA procedures can be avoided.

CONCLUSION:

Results of our study show that thyroid USG has highest accuracy for thyroid nodules when we use 5 categories keeping histopathology as gold standard.

Thyroid USG is helpful in patient management and to avoid unnecessary biopsies.

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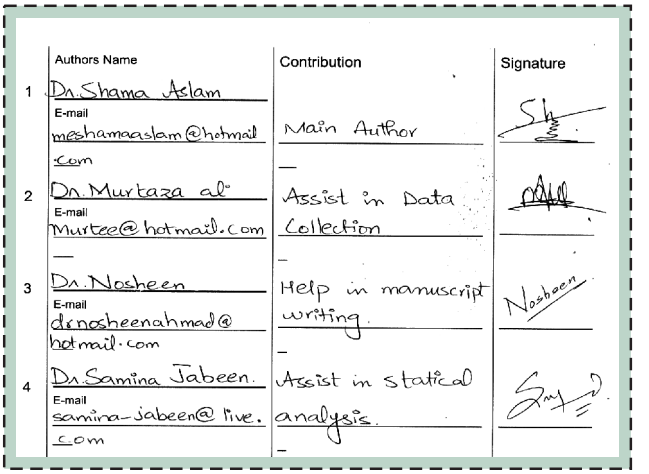

	Authors Name	Contribution	Signature
1	Dr. Shama Aslam E-mail meshamaaslam@hotmail.com	Main Author	
2	Dr. Murtaza ali E-mail Murtee@hotmail.com	Assist in Data Collection	
3	Dr. Nosheen E-mail drnosheenahmad@hotmail.com	Help in manuscript writing.	
4	Dr. Samina Jabeen. E-mail samina-jabeen@live.com	Assist in statical analysis.	

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"SURELY SILENCE CAN SOMETIMES BE THE MOST ELOQUENT REPLY."

Hazrat Ali (Karmulha Wajhay)