Role of Ultrasound in Diagnosis of Thyroiditis and Evaluation of Individual Sonographic Features in Proved Cases of Thyroiditis

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Abstract

Objective: To evaluate the role of ultrasound in the diagnosis of thyroiditis and to evaluate its sonographic features.

Methods: Thirty-nine cases included in this study, age ranged between16-65years with a mean of 39.4 years. The majority (95%) of the cases were female. Examinations were done in an outpatient clinic using real-time Sonography with the high-frequency linear probe, Following variables; gland size, its echogenicity, texture, vascularity and pattern of involvement by the disease process were recorded, then accordingly, a provisional diagnosis of thyroiditis made and reported. After that, US-guided Fine Needle Aspiration Cytology (FNA) done for the patients according to physical referral and order, while the procedure explained to the patient's and written consent. Then the final results were compared while FNA was considered as a gold standard diagnostic test.

Results: Thirty-seven cases (95%) proved to be thyroiditis with ultrasound diagnostic sensitivity of 95%. Most commonly diagnosed type of thyroiditis was chronic (69.2%). Regardless type of thyroiditis, most common sonographic features were decreased in echogenicity and heterogenic texture, they were reported among all studied cases (100%). Majority of cases (Nearly 67%) had large thyroid size and most of the patients (nearly 77%) had diffuse thyroid involvement. Regarding vascularity, decreased vascularity was most common finding (43%), while among cases of increased vascularity, majority of cases (77%) were chronic thyroiditis

Conclusions: Ultrasound is a sensitive tool and can play an important role in the diagnosis of thyroiditis, while it's available, noninvasive and cost-effective imaging modality. The decrease in echo and heterogeneity in texture are the two most common US features in the diagnosis of thyroiditis.

Keywords: *Ultrasound, Thyroiditis, Fine Needle Aspiration Cytology.*

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Introduction

High-resolution ultrasonography is the most sensitive imaging modality available for examination of the thyroid gland and associated abnormalities. Ultrasound scanning is non-invasive, widely available, not expensive, and does not use any ionizing radiation. Furthermore, real-time ultrasound imaging helps to guide diagnostic and therapeutic interventional procedures in cases of thyroid disease. The major limitation of ultrasound in thyroid imaging is that it cannot determine thyroid function, i.e., whether the thyroid gland is underactive, overactive or normal in function; for which a blood test or radioactive isotope uptake test is required[1,2].

Thyroiditis is the most common inflammatory disorders affecting thyroid gland and encountered very often in clinical practice. It has different etiologies while usually, it classified in to acute, sub-acute and chronic types[3], although on the grounds of etiopathogenic and clinical findings, eight diseases present with thyroiditis picture, including 1) Hashimoto thyroiditis; 2) subacute lymphocytic thyroiditis; 3) subacute granulomatous thyroiditis (De Quervain's disease); 4) postpartum thyroiditis; 5) infectious thyroiditis 6) toxic thyroiditis; 7) actinic thyroiditis; 8) Riedel's thyroiditis[4].

Acute thyroiditis usually has a bacterial etiology and can be very painful. May end with abscess formation [3,4]. Diagnosis usually clinical but ultrasound may help in detection of complication[1].

Sub-acute thyroiditis usually presents with a transient hyperthyroidism followed by hypothyroidism, and it encompasses two distinct varieties;

A-Subacute lymphocytic thyroiditis; which is silent and has an unknown pathogenesis or is autoimmune[3], characterized by lymphocytic infiltrates, similar to the Hashimoto thyroiditis and there is transient thyrotoxicosis[4].

B- Subacute granulomatous thyroiditis; also known as de Quervain's disease. It is uncommon disease, most often occurs in middle-aged women. It is self-limited disease often resolves spontaneously [5,6,7,8].

Chronic thyroiditis (Hashimoto's thyroiditis or strumalymphomatosa): Is the most frequent cause of permanent hypothyroidism in areas of adequate iodine intake[5,9]. At the ultrasound, in an early stage, the gland becomes heterogeneous (poorly defined hypoechoic areas permeated by fibrous echogenic layers) giving the gland a pseudo lobular appearance with micronodules scattered throughout the parenchyma. Doppler mapping usually shows a diffuse hyper vascularization pattern similar to Graves' disease. In the later stages of the disease, the gland reduced in size and become diffusely heterogeneous due to the intense fibrosis and color Doppler shows avascularised[1,4].

The main objective of this study was to determine the role of Ultrasound (US) as a simple, non-invasive, widely available and cost-effective procedure for the diagnosis of thyroiditis. While specific objectives include;

- To find the sensitivity of ultrasound in the diagnosis of thyroiditis.
- To determine the most common sonographic feature in thyroiditis.
- To find an association between some ultrasound finding and FNA result regarding types of thyroiditis.

Patients and methods

Ethical consideration: The selected topic was accepted by scientific and ethical committees of the College of Medicine, University of Sulaimani, and official acceptance was taken from health authorities to conduct this study. Only cases with the demand of referring physician were included in the study. The aim of the study was clarified to the participants, informed consent was taken from them, and collected information was kept confidential.

Inclusion criteria: Only cases with a provisional sonographic diagnosis of thyroiditis and with formal FNA request by referring physician included in the study.

Study design and examination protocol: This prospective study conducted on 39 patients in outpatient clinic, from January 2014 to August 2014. All patients were seen by a same experienced

radiologist and with the same US machine, using Madison 2.00, SONOACE X 8 US machine, with linear probe (7-12) MHz's.

After taking permission from the patients, the sonographic examination was done for them in the supine position with the hyperextended neck. The gain setting of the US done was adjusted, so that lumen of carotid arteries and jugular vein become free from echo, and thyroid hypo echogenicity diagnosed if the echo of the gland becomes equal or less than those of strap muscles. Scanning was done both in transverse and longitudinal planes. Real-time imaging of thyroid was performed using both gray-scale and color Doppler techniques. The following variables were reported in case sheets;

- Socio-demographic characteristics (age, sex)
- US finding (thyroid size, echogenicity, texture, vascularity, pattern of involvement of thyroid gland, presence of any associated thyroid nodule)

After recording US findings, sonographic diagnosis of thyroiditis was suggested and reported.
FNA was done for the patients according to a prior request from the referring physician. After an explanation of the procedure to the patient and signing informed consent, FNA was done under US guide, using 21 gauge needles. Slides were prepared and sent for cytological examination and read by an experienced histopathologist. FNA final results (positive or negative for thyroiditis) and the type of thyroiditis were recorded and reported.
Statistical Analysis: Data were entered into SPSS software package (version 21; SPSS Inc; Chikago, IL, USA) T-test and ANOVA were used to compare between groups. P-values ≤ 0.05 were considered statistically significant.

Results

Thirty-nine cases included in this study, (95%) female and 5% were male, with a female: male ratio =18.5:1. Age ranged between 16-65 years with mean age of 39.4 years Table1 shows that thirty-seven out of 39 cases were proved by FNA to be thyroiditis, with 95% sensitivity of US for detection of thyroiditis. It also shows most commonly diagnosed type of thyroiditis was chronic thyroiditis 27 cases (69.2%) while sub-acute thyroiditis was only 10 cases (25.8%).

Table 1: Correlation between thyroiditis by both US and FNA.

Variables	Frequencies	Percentages
US result	37	94.9
Positive	2	5.1
Negative	39	100.0
Total		
FNA result	27	69.2
Chronic	10	25.6
Sub-acute	2	5.1
Negative	39	100.0
Total		

Table 2: Sonographic feature of thyroiditis.

Variables	Frequencies	Percentages
Echogenicity		
Decrease	39	100.0
Increase	0	0.0
normal	0	0.0
Total	39	100.0
Thyroid size		
Small	1	2.6
Normal	12	30.8
Large	26	66.7
Total	39	100.0
Echo texture		
Heterogeneity	39	100.0
Normal	0	0.0
Total	100	0.0
Vascularity		
Increase	13	33.3
Decreased	16	41.0
Normal	10	25.6
Total	39	100.0
Pattern of involvement		
Diffuse	30	76.9
Lobar	2	5.1
Patchy	7	17.9
Total	39	100.0

Table 2 shows that regardless type of thyroiditis, most common sonographic features in FNA proved cases were decrease in echogenicity and heterogeneity in echo-texture (100%). Majority of cases (66.7%) had large thyroid size & decrease vascularity (41%) & most of the patients (nearly 76.9%) had diffuse thyroid involvement.

Table 3 demonstrates that change in vascularity (regardless type of thyroiditis) was statistically significant (p value= 0. 041) and decreased vascularity was reported as a most common finding (43.2%). Other study variables were statistically insignificant as shown in the Table 3 and Figure 1.

Table 4 shows that chronic thyroiditis was seen among younger age group while sub-acute thyroiditis reported among older with a mean age of 38.5 and 40.7 years old respectively. This difference, statistically was not significant (P value= 0.556).

The enlarged thyroid gland was detected in 80% of cases of subacute thyroiditis while in chronic thyroiditis only (63%) showed enlargement in size, this association statistically was highly significant (P value = 0.008) as shown in Table 5.

Table 3: Demonstrates associations between sex, sonographic variable in thyroiditis and their relation to FNA findings.

Studied variables	**FNA results**		**P values**
	Positive	**Negative**	
Sex			
Male	2 (5.4%)	0 (0.0%)	0.736
Female	35 (94.6%)	2 (100.0%)	
Thyroid size			
Small	1 (2.7%)	0 (0.0%)	
Normal	11 (29.7%)	1 (50.0%)	0.821
Large	25 (67.6%)	1 (50.0%)	
Vascularity			
Increase	13 (35.1%)	0 (0.0%)	
Decreased	16 (43.2%)	0 (0.0%)	**0.041**
Normal	8 (21.6%)	2 (100.0%)	
Pattern Involvement of thyroid gland			
Diffuse	28 (75.7%)	2 (100.0%)	
Lobar	2 (5.4%)	0 (0.0%)	0.721
Patchy	7 (18.9%)	0 (0.0%)	

Table 4: Relation between FNA findings and age.

Studied variables	Age (Years)	P values
	Mean ± Std. Deviation	
Types of Thyroiditis by FNA		0.556
Chronic	38.5 ± 11.2	
Sub-acute	40.7 ± 7.2	
Normal	46.0 ± 2.8	

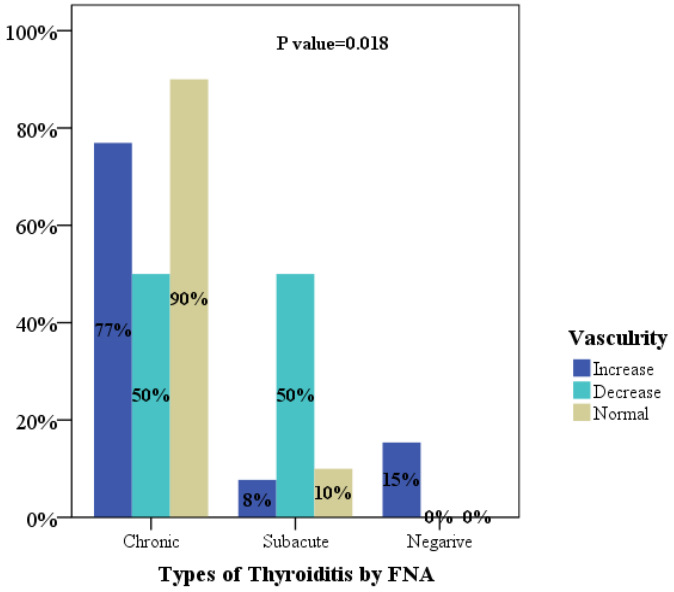

Figure 1. Association between types of thyroiditis by FNA and vascularity.

Table 5: Thyroid size about type of thyroiditis.

Types of Thyroiditis	Total	Size			P value
		Large	Normal	Small	
		N (%)	N (%)	N (%)	
Sub-acute thyroiditis	10	8 (80%)	2 (20%)	0 (0%)	
Chronic thyroiditis	27	17 (63%)	9 (34%)	1 (3 %)	**0.008**

Discussion

Thirty-nine cases included in this study, 37 female and two males, majority of the studied cases (95%) were female, and only 5% were male, with female to male ratio was equal 18.5:1 this is compatible with study done by Bhatia A. et al[10] when most of the cases (92.1%)were female also and with the most of the literature [1,4,10].

Decreased echogenicity, whether diffuse (Figure 2), patchy (Figure 3) or lobar, demonstrated in all positive cases and the prevalence of hypoechogenicity was 100%, this result is nearly similar to study done by Gutekunst et al.[11], when they reported gland hypoechogenicity in 94% among 92 cases of thyroiditis. This difference could be due to a smaller number of cases in the present study.

The decrease in echogenicity is a sensitive but not specific parameter for diagnosis of thyroiditis as there are other causes of decrease echogenicity like Graves' diseases, lymphoma and diffuse parenchymatous goiter[6] On another hand, in a study done by Rotondi et al.[12] showed that unexplained hypoechoic pattern of the normal thyroid gland was found in (2%) of non-obese and in (64.8%) patients with morbid obesity. Regarding the size of the gland; 63% of cases with chronic thyroiditis shows gland enlargement, this finding was compatible with the previous study done by Höfling et al[9], which showed that thyroid size is increased in the majority of patients with chronic thyroiditis, decreased in patients with atrophic thyroiditis, but may also be normal in some patient.

In sub-acute thyroiditis, 80% had a large size, in a study done by Vulpoi et al [13] showed that in sub-acute thyroiditis increase size seen in 100% of studied cases, this difference could be due to the stage of recovery of the disease.

In our study, gland heterogeneity was (100%) and this was compatible with a study done by IIka et al.[15] When showed heterogeneous echo-texture in 37 (97.3%) of the 38 thyroid glands.

In this study decrease in vascularity was the most common (43%), while among cases of increased vascularity (Figure 4), (35%), majority of them (77%) were chronic thyroiditis while only (8%) were reported among sub-acute thyroiditis and this association was statistically significant (P-value =0.018).

Regarding pattern of involvement (diffuse, lobe, patchy), in present study majority of cases had diffuse involvement of thyroid gland (76%), this is classical involvement of thyroid gland in thyroiditis, but involvement could be patchy or lobar also[14].

According to FNA result, we found that most of the cases (69.4%) were chronic thyroiditis (Hashimoto's thyroiditis) and this was compatible with most litterateurs were they found that chronic thyroiditis is the most common type of thyroiditis[2].

We found that besides decreased echo and gland heterogeneity, increase in size and decrease vascularity mostly seen among cases of subacute thyroiditis while the majority of cases with increase vascularity and normal size were chronic thyroiditis.

Strength points: Use of simple, noninvasive, cost-effective and widely available modality in diagnosis of thyroiditis

Weak points: 1. Small sample size, because of ethical consideration, we did FNA only for cases with a formal request from referring physician and the patient gave agreement. 2. Specificity of ultrasound in the diagnosis of thyroiditis could not be calculated because we had no true negative cases as we only included those cases with a provisional sonographic diagnosis of thyroiditis and there was lack of control groups.

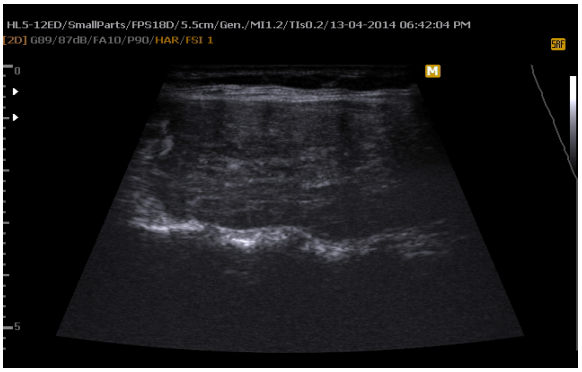

Figure 2: Sagittal plane of a thyroid lobe, diffuse decrease in echogenicity and coarsening of its architecture.

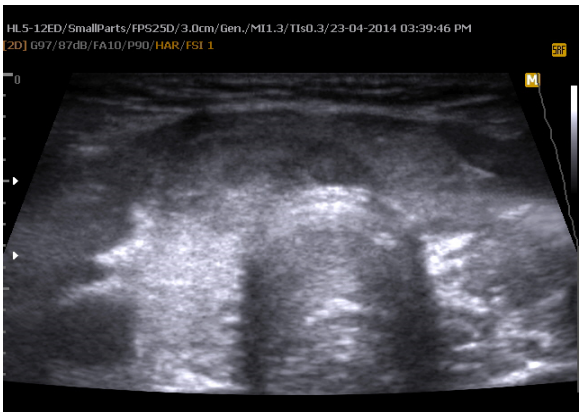

Figure 3: Shows patchy thyroiditis; the thyroid is enlarged with a multifocal decrease in echogenicity in both lobes and isthmus.

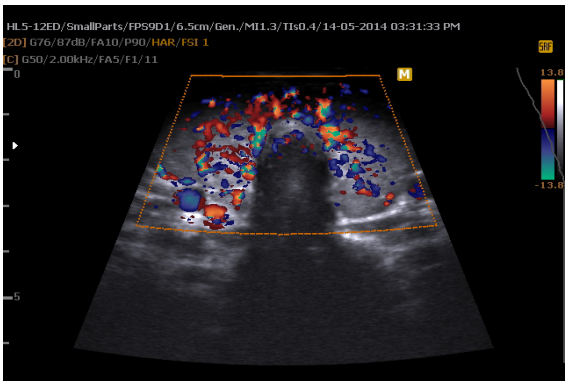

Figure 4: shows marked increase vascularity in thyroiditis.

Conclusions

1- US is a sensitive tool and can play an important role in diagnosis of thyroiditis, especially it's widely available, noninvasive low-cost imaging modality.

2- The decrease in echo and heterogenic texture is among most important radiological criteria in diagnostic of thyroiditis.

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