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A multipara metric ultrasonographic evaluation of parenchymal thyroid diseases: An observational study

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Abstract
Aim: The aim of the present study was to evaluate Parenchymal Thyroid Diseases with multipara metric Ultrasonography.
Methods: This study was conducted in the Department of Radio-diagnosis for 12 months after taking the approval of the protocol review committee and institutional ethics committee.
Results: Out of 200, 65% were male and 35% female most of the patients between 30-40 years 45% and followed by 40-50 years was 30%. The Distribution of patients was based on diseases and each group had 40 patients. When RI values were evaluated, HM (0.49±0.05) and H (0.49±0.05) groups had statistically lower values than N (0.56±0.05) and M (0.58±0.06) groups. SWV values of EH (1.19±0.18) group were statistically lower than M (1.72±0.33) and HM (1.64±0.42) groups and values of the M group (1.72±0.33) were significantly higher than H group (1.45±0.38). In thyroid diseases, the presence of H decreased SWV, while the presence of M increased SWV.
Conclusion: The present study concluded that the resistivity index, acceleration time and shear wave velocity together are reliable for differential diagnosis of parenchymal thyroid diseases.

Keywords: Elastography, Hashimoto disease, thyroid gland, ultrasonography

Introduction
Thyroid diseases are among the most common endocrine disorders seen in all age groups. They have a great impact on patient's health [1]. Most diseases are benign and often necessitate lifelong treatment and monitoring [2]. Hyperthyroidism, hypothyroidism, subclinical hypothyroidism, congenital hypothyroidism, graves disease, thyrotoxic nodule, thyroiditis, Hashimoto's thyroiditis and thyroid cancer etc. are commonly occurring thyroid diseases. The common symptoms are nervousness, weight loss, dyspnea, palpitation, increased sweating, fatigue, tachycardia, eye complaints, weakness, increased appetite, vomiting, swelling of legs, chest pain etc. [3]. Globally, thyroid cancer is increasing rapidly and resulted in 36,000 fatalities in 2010, an increase from 24,000 in 1990, although 5-year survival rates are high following treatment [4, 5].
Differential diagnosis in advanced stages of diffuse and nodular thyroid parenchymal diseases is quite difficult with grey-scale ultrasonography because findings are usually very similar to each other. Also, nodular changes in multinodular (M) form and a chronic autoimmune disease Hashimoto (H) could be seen together in clinical practice [6]. Actually, chronic autoimmune disease may show different radiologic characteristics depending on its stage: for early-stage disease (Early Hashimoto, EH) ultrasonography is done at the beginning, and for chronic-stage disease (Chronic Hashimoto, H) ultrasonography is done when the patient is under medical treatment. Different pathologic stages during the progression of the disease are hard to differentiate from each other with conventional ultrasound (US) [7, 8].
Thyroid nodules may be discovered by palpation during a general physical examination or with imaging modalities performed for medical evaluations, such as ultrasound (US), computed tomography (CT) scans, magnetic resonance imaging (MRI) studies, or 18F-fludeoxyglucose Positron Emission Tomography scanning. The latter entities are called thyroid incidentalomas and they generally do not correspond to palpable thyroid lesions. Conversely, clinicians may identify palpable thyroid lesions that do not correspond to distinct radiological entities, and therefore would not be defined as thyroid nodules [9]. Although there are many studies regarding radiological differential diagnosis of nodules (nodule–pseudo-nodule or benign–malignant nodule) in the literature.

There are not enough studies on the differential diagnosis of parenchymal changes in heterogeneous parenchyma due to diffuse or other nodular parenchymal diseases with multinodular dysplasia.

The aim of the present study was to evaluate of Parenchymal Thyroid Diseases with multipara metric Ultrasonography.

Methods

This study was conducted in the Department of Radio-diagnosis for 12 months after taking the approval of the protocol review committee and institutional ethics committee.

A total of 200 adult patients with an age range of 20-67 years of both gender were included in this study. All patients were informed regarding the study and their consent was obtained. Particulars such as name, age, and gender were recorded in case history performance. A thorough clinical examination was performed on all patients. Patients were divided into five groups such as group I (normal); Group II had first detected, early untreated Hashimoto disease (EH); Group III comprised of chronic Hashimoto patients that are under treatment and/or follow-up (H); Group IV had multinodular parenchymal hyperplasia (M); and group V had nodular hyperplasia with Hashimoto (HM). They underwent spectral Doppler ultrasound and acoustic radiation force impulse using GE LOGIQE P3 machine. Quantitative spectral Doppler parameters such as resistivity index (RI), acceleration time (AT) and quantitative elastography such as shear wave velocity (SWV) were recorded.

Statistical analysis

Results were subjected to statistical analysis for correct inference. P Value less than 0.05 was considered significant.

Results

Table 1: Age and gender distribution of patients

Age	N	%
Below 30	10	5
30-40	90	45
40-50	60	30
Above 50	40	20
Gender		
Male	130	65
Female	70	35

Out of 200, 65% were male and 35% female most of the patients were between 30-40 years 45% and followed by 40-50 years was 30%.

Table 2: Distribution of patients

Groups	Group I	Group II	Group III	Group IV	Group V
Diseases	Normal	Early untreated Hashimoto Disease (EH)	Chronic Hashimoto (H)	Multinodular parenchymal Hyperplasia (M)	Nodular hyperplasia with Hashimoto (HM)
N	40	40	40	40	40

The Distribution of patients based on diseases and each group had 40 patients.

Table 3: Assessment of spectral Doppler parameters group

Parameters	Group I	Group II	Group III	Group IV	Group V	P- value
RI	0.56±0.05	0.58±0.06	0.41±0.06	0.49±0.05	0.49±0.05	< 0.001
AT	27.35±13.66	26.60±11.74	70.00±28.28	46.74±12.09	45.45±15.65	< 0.001
SWV	1.55±0.43	1.72±0.33	1.19±0.18	1.45±0.38	1.64±0.42	< 0.001

When RI values were evaluated, HM (0.49±0.05) and H (0.49±0.05) groups had statistically lower values than N (0.56±0.05) and M (0.58±0.06) groups. SWV values of EH (1.19±0.18) group were statistically lower than M (1.72±0.33) and HM (1.64±0.42) groups and values of M group (1.72±0.33) were significantly higher than H group (1.45±0.38). In thyroid diseases, the presence of H decreased SWV, while the presence of M increased SWV.

Discussion

Primary hyperparathyroidism (PHPT) is the third most frequent endocrinopathy, after type 2 diabetes mellitus and thyroid disease. It is most commonly caused by an overactive parathyroid gland resulting in high serum parathormone (PTH) concentrations and consequent high serum calcium concentrations [10]. The application of colour and power Doppler modes has a huge benefit to determine thyroid gland vascularity. This can evaluate the disease progression, specifically with Graves' disease and thyroiditis. Moreover, it is also capable of assessing vascularity within septation in thyroid cystic lesions which RI in different groups. Assessment of AT in groups and assessment of SWV in different groups differentiates benign and malignant cysts [11].

USG is better for post-operative follow-up and for FNA and True cut needle biopsy guidance. However, it is still considered to be operator dependent, poorly identifying the retrosternal and laryngeal extension and lack of sensitivity and specificity for some cases [12]. Thyroid USG is used for the measurement of parenchymal volume, assessing vascular characteristics of the gland, screening, and differentiation of the nodules [13]. Additionally, SWV expensed the scope of elastography and enabled the quantitative examination of the nodules and the thyroid parenchyma with the help of hardware and software. Besides thyroid nodule evaluations, many works reported the value of elastography to detect changes in thyroid parenchyma in diseases that affect thyroid parenchyma including HT [14].

There are a lot of new methods and developments in the area of Doppler US and US elastography in thyroid diseases and this information could be learned from proper literature or guidelines [15, 16]. Thyroidal diseases are very common both in our country and worldwide. The high prevalence of these diseases may generate certain risks in our population. Furthermore, in recent literature, seronegative Hashimoto cases are seen in 13% of the population, and Hashimoto increases the risk of papillary thyroid malignancy. So these findings support that H should be differentiated from other

chronic parenchymal diseases even in the remission period [17, 18].

We found that The mean RI in Group I was 0.61, in Group II was 0.64, in group III was 0.49, in group IV was 0.55 and in Group V was 0.57 mean AT in Group I was 28.8, in Group II was 27.7, in group III was 72.4, in group IV was 48.7 and in group V was 47.4, mean SWV in group I was 1.62, in group II was 1.81, in group III was 1.31, in group IV was 1.55 and in group V was 1.80. The difference was significant (P< 0.05). Popoveniuc G, *et al*., [19] in their study assessed thyroid diseases by ultrasound in 167 patients. The study groups were classified into 9 groups. Authors found that thyroid USG has a great role in the assessment of thyroid disease and in their follow-up.

Conclusion

The present study concluded that the resistivity index, acceleration time and shear wave velocity together are reliable for differential diagnosis of parenchymal thyroid diseases. In conclusion, apart from subjective grey-scale US findings, parenchymal thyroid disease might be further classified with the aid of spectral Doppler US and quantitative ARFI elastography measurements, especially in suspicious cases (differentiation of senile parenchymal changes and chronic Hashimoto disease, diagnosis of autoantibodies negative Hashimoto disease, differentiation of pseudo-nodular structure from multinodular structure); diagnosis and follow-up could be done with more reliable parameters.

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