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Original Research Article

Multiparametric Ultrasonography to Assess the Parenchymal Thyroid Conditions: A Prospective Study

Sanjeev Suman[1], Babita[2], V.S.Prasad[3]

[1]Assistant Professor, Department of Radio- diagnosis, Patna Medical College and Hospital, Patna, Bihar, India

[2]Assistant Professor, Department of Microbiology, Nalanda Medical College and Hospital, Patna, Bihar, India

[3]Professor and HOD, Department of Radio- diagnosis, Patna Medical College and Hospital, Patna, Bihar, India

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Corresponding author: Dr. Babita
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Abstract

Aim: To evaluate of Parenchymal Thyroid Diseases with multiparametric Ultrasonography. **Methods:** This study was conducted in the department of Radio- diagnosis, Patna Medical College and Hospital, Patna, Bihar, India for 12 months. 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) was recorded. **Results:** Out of 300, 65% were male and 35% female most of the patients between 30-40 years 44% and followed by 40-50 years was 29.33%. The Distribution of patients based on diseases and each group had 60 patients show in table 2. 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 ($P< 0.05$). **Conclusion:** we 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 nodules have been defined by the American Thyroid Association (ATA) as “discrete lesions within the thyroid gland, radiologically distinct from surrounding thyroid parenchyma”.[1] They 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.[2]

Hyperthyroidism, hypothyroidism, subclinical hypothyroidism, congenital hypothyroidism, graves' disease, thyrotoxic nodule, thyroiditis, has himoto'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] A previous study state that, between 1992 and 2006, a total of 43,644 thyroid cancer cases wee diagnosed in the United States.[6] In China, thyroid cancer is the 8th most frequent cancer, and the rapid increase in thyroid cancer incidence represents a substantial health burden.[7,8] (Ultrasound (US) is an accepted standard diagnostic method for the detection of thyroid nodules worldwide.[9]

Differential diagnosis in advanced stages of diffuse and nodular thyroid parenchymal diseases is quite difficult with grayscale 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.[10] 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 a medical treatment. Different pathologic stages during progression of the disease are hard to differentiate from each other with the conventional ultrasound (US).[11,12] 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 differential diagnosis of parenchymal changes in heterogeneous parenchyma of H, due to diffuse or other nodular parenchymal diseases with multinodular dysplasia.

Material and Methods

This study was conducted in the Department of Department of Radio-diagnosis, Patna Medical College and Hospital, Patna, Bihar, India for 12 months. after taking the approval of the protocol review committee and institutional ethics committee.

Methodology

Total 300 adults patients with age range 20-67 years both the gender were include in this study. All patients were informed regarding the study and their consent was obtained. Particulars such as name, age, gender was recorded in case history performa. A thorough clinical examination was performed in 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) was recorded.

Statistical analysis

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

Results

Out of 300, 65% were male and 35% female most of the patients between 30-40 years 44% and followed by 40-50 years was 29.33% shows in table1. The Distribution of patients based on diseases and each group had 60 patients show in table 2. 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). table.3

Table 1: Age and gender distribution of patients

Gender	N=300	%
Male	195	65
Female	105	35
Age		
Below 30	15	5
30-40	132	44
40-50	88	29.33
Above 50	65	21.67

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)
Number	60	60	60	60	60

Table 3: Assessment of spectral doppler parameters group

Parameters	Group I	Group II	Group III	Group IV	Group V	P- value
RI	0.61	0.64	0.49	0.55	0.57	0.01
AT	28.8	27.7	72.4	48.7	47.4	0.001
SWV	1.62	1.81	1.31	1.55	1.80	0.01

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.[13,14]

The application of color and power doppler modes has 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 septations 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.[15] 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 dependant, poorly identify the retrosternal and laryngeal extension and lack of sensitivity and specificity for some cases.[16] Thyroid

USG is used for the measurement of parenchymal volume, assessing vascular characteristic of gland, screening, and differentiation of the nodules.[17] After the technologic developments about the transducers and high resolution screens, gray scale and Doppler examinations became easier.[18] 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 value of elastography to detect changes of thyroid parenchyma in diseases that affects thyroid parenchyma including HT.[19] The present study was conducted to determine parenchymal thyroid diseases using Ultrasonography (USG) in adult patients. In present study, we included 300 adult 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). Yildirim et al,[20] in their study evaluated findings of 227 patients (179 females, 48 males) that underwent spectral Doppler ultrasound and acoustic radiation force impulse. Authors found no significant effect of gender or volume on the differentiation of disease pattern. RI (0.41 ± 0.06) and SWV values (1.19 ± 0.18 m/s) were the lowest. AT values (>55 ms) were the highest in EH group. Existence of H decreased RI and SWV values, while it extended AT in a different thyroid disease. 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,[21] in their study assessed of thyroid diseases by ultrasound in 167 patients. The study groups were classified into 9 groups. Authors found that thyroid USG has great role in 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.

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