

Quantitative Assessment of the Parenchymal Thyroid Diseases using Multiparametric Ultrasonography

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Conflict of interest: Nil

Abstract

Aim: To assess some quantitative spectral Doppler parameters, resistivity index (RI) and acceleration time (AT) together to show their reliability for differential diagnosis of parenchymal thyroid diseases.

Methods: This study was conducted in the Department of Radiology, ICARE Institute of Medical Sciences and Research & Dr. Bidhan Chandra Roy Hospital, Haldia, West Bengal, India, for the period of 1 year. 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 Siemens ACUSON S2000 machine. Quantitative spectral doppler parameters such as resistivity index (RI) and acceleration time (AT) was recorded.

Results: Out of 200, 62.5% were male and 37.5% female most of the patients between 30-40 years 42.5% and followed by 40-50 years was 30%. The Distribution of patients based on diseases and each group had 40 patients. The mean RI in group I was 0.57, in group II was 0.60, in group III was 0.45, in group IV was 0.51 and in group V was 0.53. Mean AT in group I was 25.9, in group II was 24.8, in group III was 69.5, in group IV was 45.8 and in group V was 44.5. The difference was significant ($P < 0.05$).

Conclusion: The resistivity index and acceleration time together are reliable for differential diagnosis of parenchymal thyroid diseases.

Keywords: Hashimoto disease, thyroid gland, ultrasonography

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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] Thyroid nodules are commonly benign and the reported prevalence widely varies depending on the population studied and the methods used

to detect the nodules. [2] 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. [3-5] A previous study state that, between 1992 and 2006, a total of 43,644 thyroid cancer cases were 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 gray-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. [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 Radiology, ICARE Institute of Medical Sciences and Research & Dr.

Bidhan Chandra Roy Hospital, Haldia, West Bengal, India, for the period of 1 year

Methodology

The technique, risks, benefits, results and associated complications of the procedure were discussed with all patients. Total 200 adults patients with age range 18-58 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 Siemens ACUSON S2000 machine. Quantitative spectral doppler parameters such as resistivity index (RI) and acceleration time (AT) 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 200, 62.5% were male and 37.5% female most of the patients between 30-40 years 42.5% and followed by 40-50 years was 30% shows in table 1.

Table 1: Age and gender distribution of patient

Gender	N=200	%
Male	125	62.5
Female	75	37.5
Age		
Below 30	12	6
30-40	85	42.5
40-50	60	30
Above 50	43	21.5

The Distribution of patients based on diseases and each group had 40 patients show in table 2.

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	40	40	40	40	40

The mean RI in group I was 0.57, in group II was 0.60, in group III was 0.45, in group IV was 0.51 and in group V was 0.53. Mean AT in group I was 25.9, in group II was 24.8, in group III was 69.5, in group IV was 45.8 and in group V was 44.5. The difference was significant ($P < 0.05$). table.3

Table 3: Assessment of spectral doppler parameters group

Parameters	Group I	Group II	Group III	Group IV	Group V	p-value
RI	0.57	0.60	0.45	0.51	0.53	0.01
AT	25.9	24.8	69.5	45.8	44.5	0.001

Discussion

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. [13] 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. [14] Thyroid USG is used for the measurement of parenchymal volume, assessing vascular characteristic of gland, screening, and differentiation of the nodules. [15] After the technologic developments about the transducers and high resolution screens, gray scale and Doppler examinations became easier. [16,17] The present study was conducted to determine parenchymal thyroid diseases using Ultrasonography (USG) in adult patients. In present study, we included 200 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, [18] 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) was the lowest. AT values (>55 ms) were the highest in EH group. Existence of H decreased RI values, while it extended AT in a different thyroid disease. We found that the mean RI in group I was 0.57, in group II was 0.60, in group III was 0.45, in group IV was 0.51 and in group V was 0.53, mean AT in group I was 25.9, in group II was 24.8, in group III was 69.5, in group IV was 45.8 and in group V was 44.5, mean SWV in group I was 1.49, in group II was 1.68, in group III was 1.18, in group IV was 1.42 and in group V was 1.67. The difference was significant ($P < 0.05$). Popoveniuc G, et al, [19] 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. [20]

Limitation of the study

The study is small sample size. Only one radiologist examined all the images. There can be radiologist specific errors.

Conclusion

The resistivity index and acceleration time together are reliable for differential diagnosis of parenchymal thyroid diseases.

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