An observational study to determine parenchymal thyroid diseases using Ultrasonography (USG) in adult patients

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Abstract

Aim: To determine parenchymal thyroid diseases using Ultrasonography (USG) in adult patients.

Methodology: This study was conducted in the department of Radio-diagnosis, Maharishi Markandeshwar University, Solan. It comprised of 75 adult patients age ranged 21-70 years of age. All patients were well informed regarding the study and their consent was obtained. Particulars such as name, age, gender was recorded in case history proforma. 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). All examinations were performed with the patient in a supine position with the neck hyperextended. We calculated the thyroid volume with an automated formula (length £ width £ depth £ 0.52). We categorized the thyroid gland echogenicity as hypoechoic, isoechoic or hyperechoic relative to the cricoid cartilage. We evaluated the parenchyma for the presence of nodules, as well as the visibility of tiny echogenic reticulations.

Results: Out of 75 cases, 35 (46.7%) were males and 40 (53.3%) were females. Each group included 15 patients each. Mean RI in group I was 0.53, in group II was 0.54, in group III was 0.40, in group IV was 0.49 and in group V was 0.51. Mean AT in group I was 26.0, in group II was 25.5, in group III was 71.1, in group IV was 46.6 and in group V was 44.8. Mean SWV in group I was 1.57, in group II was 1.69, in group III was 1.14, in group IV was 1.47 and in group V was 1.60. The difference was significant ($P < 0.05$).

Conclusion: Real-time ultrasonography can be helpful for accurately diagnosing TD and ultrasound finding of two or more TD features has good diagnostic accuracy.

Keywords: USG, diffuse thyroid disease, Hashimoto thyroiditis

Introduction

Thyroid diseases are the most common endocrine disorders seen in all age groups. They havegreat impact on patients' health [1]. It includes diffuse and nodular types [2]. Diffuse thyroid disease (DTD) is a primary cause of thyroid dysfunction and early detection of subclinical DTD can be helpful in the appropriate management of thyroid dysfunction [3]. Most of diseases are benign and often necessitate life-long treatment and monitoring [4]. Hyperthyroidism, Hypothyroidism, Subclinical hypothyroidism, Congenital hypothyroidism, Grave's disease, Thyrotoxic nodule, thyroiditis, Hashimoto's thyroiditis and Thyroid cancer etc. are commonly occurring thyroid diseases. The common symptoms are weight loss, nervousness, dyspnea, palpitation, increased sweating, fatigue, tachycardia, eye complaints, weakness, increased appetite, vomiting, swelling of legs, chest pain etc. [5].

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 [6]. Moreover, 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) [7, 8].

Ultrasonography (USG) is routinely performed procedure in patients with thyroid diseases. It is considered potent diagnostic tool. It is safe, cheap, time saving and has high sensitivity and specificity for thyroid lesion characterization. It can characterize most of thyroid lesions and detect small sized nodules less than 3 mm [9]. Chronic autoimmune disease can present different radiologic characteristics based on its stage: for early stage disease (Early Hashimoto, EH) ultrasonography is performed at the beginning, and for chronic stage disease (Chronic Hashimoto, CH) ultrasonography is done when the patient is under a medical treatment. Thus conventional ultrasound may not be able to differentiate thyroid diseases at different pathologic stages. In such cases, quantitative spectral Doppler parameters, resistivity index (RI), acceleration time (AT) and quantitative elastography such as shear wave velocity (SWV) may be helpful [10].

Materials and Methods

This study was conducted in the department of Radio-diagnosis, Maharishi Markandeshwar University, Solan. It comprised of 75 adult patients age ranged 21-70 years of age. All patients were well informed regarding the study and their consent was obtained. Particulars such as name, age, gender was recorded in case history proforma.

Methodology

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), acceleration time (AT) and quantitative elastography such as shear wave velocity (SWV) was recorded. Results were subjected to statistical analysis for correct inference.

All examinations were performed with the patient in a supine position with the neck hyperextended. We calculated the thyroid volumes with an automated formula (length £ width £ depth £ 0.52). We categorized the thyroid gland echogenicity as hypoechoic, isoechoic orhyperechoic relative to the cricoid cartilage. We evaluated the parenchyma for the presence of nodules, as well as the visibility of tiny echogenic reticulations.

Results

Out of 75 cases, 35 (46.7%) were males and 40 (53.3%) were females. Each group included 15 patients each.

Table 1: Distribution of patients in 5 groups according to disease

Groups	Group I	Group II	Group III	Group IV	Group V
Diseases	Normal	EH	H	M	HM
Number	15	15	15	15	15
Male	7	6	7	7	8
Female	8	9	8	8	7

Mean RI in group I was 0.53, in group II was 0.54, in group III was 0.40, in group IV was 0.49 and in group V was 0.51. Mean AT in group I was 26.0, in group II was 25.5, in group III was 71.1, in group IV was 46.6 and in group V was 44.8. Mean SWV in group I was 1.57, in group II was 1.69, in group III was 1.14, in group IV was 1.47 and in group V was 1.60. The difference was significant (P< 0.05).

Table 2: Assessment of spectral Doppler parameters in all the groups

Parameters	Group I	Group II	Group III	Group IV	Group V	P value
RI (Resistivity index)	0.53	0.54	0.40	0.49	0.51	0.016
AT (Acceleration time)	26.0	25.5	71.1	46.6	44.8	0.002
SWV (Shear wave velocity)	1.57	1.69	1.14	1.47	1.60	0.02

Discussion

Thyroid diseases (TD), as a less common pediatric health problem, constitutes 10% to 15% of the CH etiologies that affect the neurologic development, growth curve and cognitive capacity in early childhood [11]. Thyroid US is the initial imaging modality in patients with a thyroid function disorder. A qualitative description of markedly heterogeneous and enlarged thyroid glands with hypo or isoechogenicity, as well as pronounced hypervascularity mimicking a thyroid inferno pattern seen in Graves' disease, have been reported for TD [11].
Several studies have evaluated TD by means of a thyroid US classification system consisting of four categories based on the number of positive US findings of TD [12-14]. According to the results of these studies, thyroid US with specifically defined US classifications had good accuracy in the diagnosis of TD. One investigator compared real-time and static US diagnoses for incidental TD [12].
According to the results of that single-center study, both methods may be helpful for the detection of TD, although real-time US is superior to static US for detecting incidental TD [12].In a 2014 study [15], several investigators analyzed the diagnostic role of conventional US and shear-wave elastography in the evaluation of TD. Those investigators contended that conventional US did not have reliable diagnostic accuracy or adequate inter-observer agreement among three experienced radiologists.
Thyroid USG is used for the measurement of parenchymal volume, assessing vascular characteristic of gland, screening and differentiation of the nodules [16]. After the technologic developments about the transducers and high resolution screens, gray scale and Doppler examinations became easier [17]. Additionally, SWV expensed the scope of elastography and enabled the quantitative examination of the nodules and the thyroid parenchyma with the helpof 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 [18].
Mean RI in group I was 0.53, in group II was 0.54, in group III was 0.40, in group IV was 0.49 and in group V was 0.51. Mean AT in group I was 26.0, in group II was 25.5, in group III was 71.1, in group IV was 46.6 and in group V was 44.8. Mean SWV in group I was 1.57, in group II was 1.69, in group III was 1.14, in group IV was 1.47 and in group V was 1.60. 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.

Conclusion

From this study, it can be said that resistivity index (RI), acceleration time (AT) and shear wave velocity together are reliable for differential diagnosis of parenchymal thyroid diseases. Real-time ultrasonography can be helpful for accurately diagnosing TD and ultrasound finding of two or more TD features has good diagnostic accuracy.

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