Thyroid Ultrasonography in Differentiation between Graves' Disease and Hashimoto's Thyroiditis

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ABSTRACT

Objective: Graves' disease and Hashimoto's thyroiditis are the most common causes of hyper and hypothyroidism, respectively. Differentiation of these 2 diseases, if the patient is euthyroid, may sometimes be extremely difficult on the basis of clinical and laboratory findings. The purpose of this study was to determine the sensitivity and specificity of gray scale sonography in differentiation of Graves' disease from Hashimoto's thyroiditis.

Methods: This study included 149 patients divided into three groups, patients with Graves' disease (34 patients, mean age = 36.8 ± 10.17 years), Patients with Hashimoto's thyroiditis (62 patients, mean age = 33.4 ± 12.16 years) and control group (53 healthy people, mean age = 34.74 ± 16.87 years). Members of all groups were referred to a single radiologist for thyroid sonography for evaluation of thyroid echogenicity pattern.

Results: A total of 117 women and 32 men were examined by sonography. The most common sonographic pattern in Hashimoto and Graves' was homogenous hypo-echogenicity which was observed in 45.2% and 47.1% of cases, respectively. Peripheral hypo-echogenicity pattern was seen in 40.3% of Hashimoto's group with 100% specificity and 40.3% sensitivity. Central-hypoechogenic pattern was observed in 17.6% of Graves' group with 100% and 17.6% specificity and sensitivity, respectively.

Conclusion: Our findings indicate that sonography has high specificity but low sensitivity in the diagnosis of either Graves' disease or Hashimoto's thyroiditis. It is therefore not possible to differentiate between these two diseases using sonography alone. Confirmation by laboratory data is also needed.

Keywords

Hashimoto's thyroiditis, Graves' disease, thyroid sonography

Introduction

Graves' disease and Hashimoto's thyroiditis are two common auto-immune diseases of thyroid gland. Hashimoto's thyroiditis or chronic lymphocytic thyroiditis is the most common cause of goiter in regions with no iodine deficiency. In this disease the thyroid gland is gradually destroyed by cell and antibody mediated immune process. Graves' disease is the most common cause of hyperthyroidism [1].

Due to limitations in physical examination of the thyroid gland and recent advances in sonographic technology, nowadays, ultrasonography is being increasingly used to assist in the diagnosis of thyroid diseases [2].

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Received: 12 April 2016
Accepted: 10 July 2016

Sonograhphy is safe as it doesn't use ionizing radiation and does not cause tissue damage. It is also more affordable than the other imaging modalities. Since it is a noninvasive modality, patients are comfortable during the process. No specific preparation or discontinuation of medications is needed for this procedure [3]. Thyroid sonography is conventionally used in the evaluation of thyroid nodules and during their fine needle aspiration biopsy. Thyroid lobes and nodules can be accurately measured by sonography. Thyroid echogenicity and calcifications as well as their patterns are easily detected by this modality [4].

Differentiation of euthyroid Graves' disease from euthyroid Hashimoto's thyroiditis may sometimes be extremely difficult on the basis of clinical and laboratory findings such as thyroid antibodies [1]. Since sonography has so many advantages as mentioned above, it should be highly helpful if the aforementioned two of the most common diseases could be differentiated from each other. The objective of this study is to determine the sensitivity and specificity of ultrasonography in the diagnosis of Graves' disease and Hashimoto's thyroiditis. This is tried by comparing the sonographic findings of the thyroids in these two diseases looking for any possible differences.

Methods

This is a test assessment study which compares gray scale sonography with clinical and lab data which are the gold standards in the diagnosis of Graves' disease and Hashimoto's thyroiditis. Laboratory data included measurements of thyroid hormone levels and anti-thyroid antibodies (anti-thyroid peroxidase and anti-thyroglobulin).

Excluded from the study were patients with uncertain diagnosis of Graves' disease or Hashimoto's thyroiditis, those with history of thyroid surgery and also patients with palpable nodules. 96 patients (34 Graves' and 62 Hashimoto's disease) whose diseases had been definitely diagnosed were included in the study. The mean age of patients in Graves' group was 36.82 ± 10 years and that of those in Hashimoto's group was 35.4 ± 10 years. 53 healthy individuals were chosen as control group. The mean age of patients in the control group was 34.74 ± 16.84 years (Table 1).

Patients and controls were referred to a single radiologist for sonographic examination of the thyroid gland and the description of sonographic findings such as patterns of echogenicity and nodularity. The radiologist was blind to the diagnoses.

Five patterns of echogenicity in the thyroid gland were evaluated in this study as is described: homogeneous hypoechogenicity, peripheral hypoechogenicity, central hypoechogenicity, homogeneous isoechogenicity, and homogeneous hyperechogenicity.

The ultrasound study was performed using MEDISON Accuvix V10 sonography unit

Table 1: Characteristics of the study groups in terms of age and gender.

Groups	Number	Minimum age	Maximum age	Mean age	SD	sex	frequency	Percentage %
Control group	53	8	84	34.74	16.84	Female	41	77.40
						male	12	22.60
Graves' disease	34	21	67	36.82	10.18	Female	17	50.00
						male	17	50.00
Hashimoto's thyroiditis	62	11	62	33.40	12.16	Female	59	95.20
						male	3	4.80

with 10 MHZ linear transducer. Thyroid gland echogenicity was compared with patient's submandibular glands and the gain of sonographic system was set to produce an echo free appearance in the lumen of internal jugular vein and carotid artery.

Statistical analyses were performed using the statistical package for social sciences software, version 15.0 for windows (SPSS 15.0).

Results

149 thyroid sonographies were performed in 117 women and in 32 men. 86 patients were positive for anti thyroid peroxidase (anti-Tpo) and in 77 had higher than normal anti-thyroglobuline levels (anti Tg). In normal cases anti-Tpo was 100% negative but only in one control group case (1.88%) anti Tg was positive (Table 2). In fact the positivity of anti-Tpo and anti Tg between the three groups was significantly different ($p<0.0001$).

Nodularity was observed in 28.18% of total cases. In control, Graves' and Hashimoto's groups nodularity was detected in 26.4%, 29.4% and 29% respectively, so that the positivity of nodularity was not significantly different in three groups ($p=0.937$) (Table 3).

Homogeneous hypoechogenicity was seen in 45.2% of Hashimoto's cases, 47.1% of Graves' disease cases and 9.4% of control group (Table 4). According to these results homogeneous hypoechogenicity was the most common sonographic pattern in both diseases in this study. Peripheral hypoechogenicity was the second most common pattern in Hashimoto's thyroiditis which was detected in 40.3% of cases. Central hypoechogenicity was the second most common sonographic pattern in

Table 2: Number and percentage of positive and negative antibody in each group.

Groups	Anti TPO		Anti Tg	
	+	-	+	-
Control group	0	53	1	52
	0%	100%	1.88%	98.11%
Graves' disease	24	10	14	20
	70.58%	29.41%	41.17%	58.82%
Hashimoto's thyroiditis	62	0	62	0
	100%	0%	100%	0%

Table 3: Nodularity in groups under study.

Groups	Nodularity	Frequency	Percent
Control group	-	39	73.60
	+	14	26.40
Graves' disease	-	24	70.60
	+	10	29.40
Hashimoto's thyroiditis	-	44	71.00
		18	29.00

Table 4: Number and percentage of different sonographic patterns.

Patients / Sonographic pattern	Hashimoto's thyroiditis	Graves' disease	Control group	Total	p-value
homogenously hypoechoic	28 45.2%	16 47.1%	5 9.4%	49 100%	0.000
peripherally hypoechoic	25 40.3%	5 14.7%	0 0%	30 100%	0.000
centrally hypoechoic	4 6.5%	6 17.6%	0 0%	10 100%	0.006
homogenously isoechoic	5 8.0%	2 5.9%	26 49.1%	33 100%	0.000
homogenously hyperechoic	0 0%	5 14.7%	22 41.5%	27 100%	0.000
Total	62	34	53	149	

Graves' disease. Alternatively, it can be said 83.3% of patients with peripheral hypoechogenicity were in Hashimoto's thyroiditis group and 60% of central hypoechoic patterns were in Graves' group (Table. 4).

The most common pattern of echogenicity control group was homogeneous isoechogenicity which was observed in 49.1% of cases. The next pattern was homogeneous hyperechogenicity that was seen in 41.5% of the cases (Table 4).

Homogeneous hypoechogenicity in Hashimoto's thyroiditis had a specificity and sensitivity of 90.6% and 45.2%, respectively. In case of patients in Graves' disease the above percentage were 90.6% and 47.1%, respectively (Table 5).

Peripheral hypoechogenicity in Hashimoto's thyroiditis had 100% specificity and 40.3 % sensitivity. Central Hypoechogenicity in Graves' disease had 100% specificity and 17.6% sensitivity (Table. 5).

Discussion

Although in some previous studies it has been declared that there is no significant correlation between thyroid echogenicity and serum anti-Tpo titers [5], but Zheng et al determined that patients with thyroid parenchymal low echogenicity have a more chance of being positive for anti-Tpo and anti Tg [6]. As seen in Table 2, in our study Hashimoto's group patients selected had positive anti-Tpo and anti Tg.

As depicted in to Table 3, the frequency of nodularity in our study was 28.18% which is close to the findings of Anderson et al. They detected a single nodule in 36% of their Hashimoto's cases. 84% of their Hashimoto's nodules were benign (13, 14). Some other studies reported nodularity of 42% [4].

In this study different echogenity patterns including peripheral and central hypoechogenicity were evaluated. To the best of our knowledge presence of these patterns has not been evaluated in previous studies in the diagnosis and/or differentiation of Graves' disease and Hashimoto's thyroiditis.

As seen in Table 4, the most common sonographic pattern in our patients with Hashi-

Table 5: Sensitivity and specificity of different sonographic patterns in Hashimoto's thyroiditis and Graves' disease.

Sonographic pattern		Hashimoto's thyroiditis		Sensitivity	Specificity	Graves' disease		Sensitivity	Specificity
		-	+			-	+		
homogenously hypoechoic	-	48	34	45.2%	90.6%	48	18	47.1%	90.6%
	+	5	28			5	16		
peripherally hypoechoic	-	53	37	40.3%	100%	53	29	14.7%	100%
	+	0	25			0	5		
centrally hypoechoic	-	53	58	6.5%	100%	53	28	17.6%	100%
	+	0	4			0	6		
homogenously isoechoic	-	27	57	8.1%	50.9%	27	32	5.9%	50.9%
	+	26	5			26	2		
homogenously hyperechoic	-	31	62	0%	58.5%	31	29	14.7%	58.5%
		0	22			22	5		

moto's disease was homogeneous hypoechogenicity which is not consistent with the findings of Marcocci et al. Their finding was 18.5% hypoechogenicity in auto-immune thyroiditis [7]. Diffuse hypoechogenicity was most common in Hashimoto's thyroiditis [6, 8, 9].

Marcocci et al also demonstrated that thyroid hypoechogenicity is not specific for Hashimoto's thyroiditis and may be observed in Graves' disease or sub-acute thyroiditis [7]. This has been confirmed by Vitti et al who suggested that thyroid hypoechogenicity is characteristic for auto-immune thyroid disease including Hashimoto's and Graves' disease [10]. This point is confirmed by our study. Our results reveal that hypoechogenicity is not specific for Hashimoto's thyroiditis and can also be seen in Graves' disease.

Thyroid echogenicity is significantly low in Graves' disease, and there is a correlation between thyroid echogenicity and anti-thyroid antibodies level [11]. In patients with normal thyroid sonography there is no significant hypothyroidism or hyperthyroidism [12]. In our study, none of control cases had peripheral or central hypo echogenicity and this means that any patient with these patterns of echogenicity should be evaluated for auto-immune thyroid disease. Moderate to severe hypoechogenicity can predict thyroid auto-immune disorders, even without clinical suspicion [13].

As shown in Table 5, sonography has a high specificity (90.6%) but low sensitivity (47.1% and 45.2%) in the diagnosis and differentiation of Graves'disease and Hashimoto thyroiditis. These findings are similar to those of Tabur et al: They found that sonography has high specificity (90%) and low sensitivity (35%) in thyroiditis [14]. However Kim et al found 92.1% specificity and 87.7% sensitivity for sonography in determination of asymptomatic cases of diffuse thyroid disease. This is not confirmed by our study [15].

Conclusion

In conclusion, our findings indicate that because of low sensitivity of sonography, dif-

ferentiation between Graves' disease and Hashimoto's thyroiditis is not possible but due to high specificity it can differentiate normal thyroid from Graves' disease or Hashimoto's thyroiditis. It is suggested that if thyroiditis or Graves' disease is defined by sonography, it should be further confirmed by clinical and laboratory with laboratory data.

Acknowledgment

The authors would like to thank Dr. B. Zeinali-Rafsanjani of the Department of Radiology of Shiraz University of Medical Sciences for her valuable assistance with manuscript editing.

Conflict of Interest

None

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