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A CROSS SECTIONAL STUDY TO ASSESS THE RELATIONSHIP BETWEEN ULTRASOUND FINDINGS AND THYROID FUNCTION IN ADOLESCENTS WITH AUTOIMMUNE DIFFUSE THYROID DISEASE

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ABSTRACT

Objective: To evaluate the relationship between ultrasound findings and thyroid function in adolescents with autoimmune diffuse thyroid disease. **Methods:** We conducted a prospective study of 70 adolescent patients in the Department of Radiodiagnosis, NSCB Zonal Hospital, Mandi with dysregulated thyroid function. We evaluated the association between thyroid echogenicity and heterogeneity seen on ultrasound and thyroid function in adolescent patients with autoimmune diffuse thyroid disease. We conducted this study for a period of months between March 2021 and August 2021. **Results:** Our review of ultrasound focused on decreased echogenicity and increased heterogeneity, which was subsequently classified into 4 grades. When we compared ultrasound grades according to thyroid status, more severe thyroid dysfunction was significantly associated with higher ultrasound grade. **Conclusion:** In adolescent patients with autoimmune diffuse thyroid disease, it was concluded that, there is a direct relationship between decreased echogenicity and heterogeneity on ultrasound and thyroid dysfunction.

KEYWORDS: Adolescents, thyroid function, ultrasound, autoimmune diffuse thyroid disease.

INTRODUCTION

Autoimmune diffuse thyroid disease (AITD) is a multifactorial disease in which autoimmunity against thyroid antigens develops in a particular genetic background facilitated by exposure to environment factors. Clinically relevant thyroid antigens are thyroid peroxidase (TPO), thyroglobulin (TG) and thyroid-stimulating hormone receptor (TSHR). Autoimmunity against these self-antigens gives rise to thyroid antibodies (Abs). TPO-Ab and TG-Ab are the hallmark of chronic lymphocytic thyroiditis (which may lead to Hashimoto's hypothyroidism(HT) although most patients will remain euthyroid. TSHR-Abs are the hallmark of Graves' disease(GD) resulting in Graves' hyperthyroidism. Hashimoto's hypothyroidism and Graves' hyperthyroidism can be viewed as the opposite ends of a continuous spectrum of AITD, but in reality there is substantial overlap between Hashimoto's and Graves' diseases. The prevalence of these chronic thyroid disorders in children and adolescents is approximately 9.6% and 1.3 % respectively.[1] Generally when a patient presents with suspicion of AITD, biochemical parameters including thyroid function and antibody levels are checked, and ultrasound is usually performed to check for parenchymal abnormalities or emergence of focal lesions.[2] Multiple previous studies have been done in past to ascertain the correlation between ultrasound and biochemical markers in case of AITDs.[3,4,5,6,7,8] Decreased echogenicity on ultrasound is usually associated with overt hypothyroidism.[9] Subclinical hypothyroidism have also been associated with changes on ultrasound.[8] Hypo-echogenicity and heterogeneity on ultrasound in patients can be taken as early sign of thyroid failure. Thyroid ultrasound in sub clinical hypothyroidism has a good prognostic value, this is because subclinical thyroid dysfunction tends to develop into overt thyroid dysfunction.[10] Progression to overt hypothyroidism in subclinical hypothyroid patients is also associated with adverse effect on lipid metabolism and cardiovascular system.

MATERIALS AND METHODS

This was a prospective study conducted in the department of Radiodiagnosis. This study was performed in accordance with guidelines laid in 1964 Helsinki Declaration. Ethical clearance was obtained from the institution. Whole procedure was explained to the patients and their guardians prior to the beginning of ultrasound examination and consent was obtained from them. This study included 70 adolescent patients diagnosed with autoimmune hypothyroidism on the basis of clinical and laboratory investigations. Laboratory data obtained from the medical records were evaluated retrospectively, including the serum levels of free

triiodothyronine (T3), free thyroxine (FT4), TSH, anti-microsomal antibody, and antithyroglobulin autoantibodies (TGAbs). Thyroid function was subdivided into overt hypothyroidism (I a), subclinical hypothyroidism (I b), euthyroid (II), and hyperthyroidism (III). Overt hypothyroidism was defined by decreased concentrations of T4 and elevated serum concentrations of TSH (>20 mU/L). I b was defined as an increased serum TSH level and normal free thyroid hormone levels. Patients with normal levels of TSH and free thyroid hormones were deemed as II. The normal ranges of TSH, FT4, and FT3 were 0.27 to 4.2, 0.93 to 1.71, and 0.85 to 2.02 mU/L, respectively. Ultrasound and colour doppler evaluation was done on the selected patients using 5 to 12 MHz linear array transducer of Siemens Acuson ultrasound machine. The ultrasound patterns of the patients were divided into 4 grades: Grade 1(G1): diffusely enlarged gland with a isoechoic ultrasound pattern(Fig 1), Grade 2(G2): multiple hypoechoic foci or patches scattered throughout an otherwise normal echogenic gland and involving <1/3 of the gland (fig.2), Grade 3(G3):an enlarged gland with diffuse but mild hypo-echogenicity (fig.3), Grade 4(G4): an enlarged gland with diffuse, marked hypo-echogenicity.

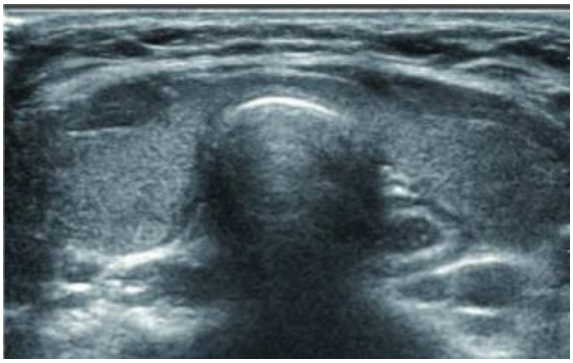

Figure 1: Grade 1.

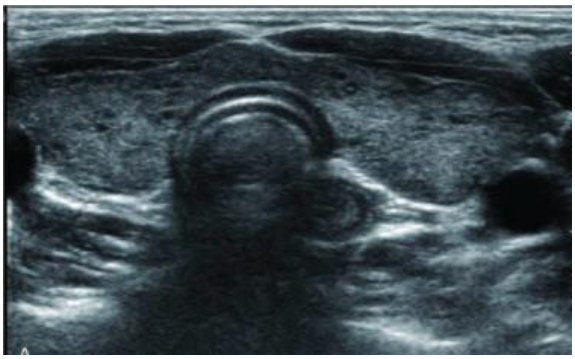

Figure 2: Grade 2.

Figure 3: Grade 3.

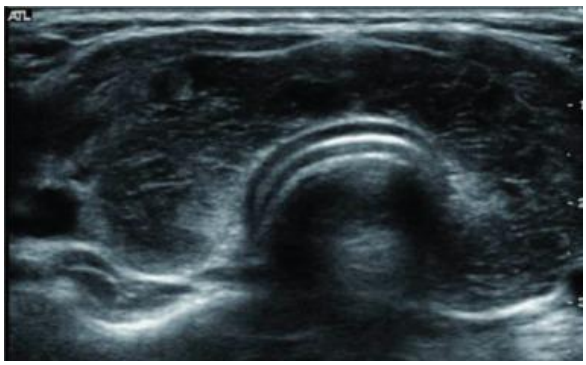

Figure 4: Grade 4.

All the statistical analyses were done using using IBM SPSS Statistics 20.

RESULTS

The mean age of the patients was 15+/- 3.7 years. There were 10(14.28%) female patients and 60(85.71%) male patients. Table 1 summarizes the relationship between ultrasound grade and functional thyroid status. There were 23(32.85%), 18(25.71%), 15(21.42%) and 14(20%) patients categorized into grade 1, 2, 3 and 4 respectively. G1 and G2 groups included 1(4.3%/5.5%) patient each of overt hypothyroidism, 12(52.17%) and 10(55.55%) cases of subclinical hypothyroidism, 10(43.47%) and 6(33.33%) cases of euthyroid status respectively. In addition, 1(5.5%) patient in G2 group had hyperthyroidism. In G3 group, 12(80%) patients had overt hypothyroidism, 1(6.66%) patient had subclinical hypothyroidism and none of the patient was euthyroid. In G4 group all the 14 (100%) patients had overt hypothyroidism. Our results clearly indicated that patients with higher grades ultrasound grades had decreased thyroid function.

Table 1: Relationship between ultrasound grade and functional thyroid status.

ULTRASOUND GRADE / THYROIDFUNCTION	GRADE 1 (n = 23)	GRADE 2 (n = 18)	GRADE 3 (n = 15)	GRADE 4 (n = 14)
I a	1(4.3%)	1(5.5%)	12(80%)	100%
I b	12(52.17%)	10(55.55%)	1(6.66%)	0%
II	10(43.47%)	6(33.33%)	0(0%)	0%
III	0(0%)	1(5.5%)	2(13.33%)	0%

DISCUSSION

Our study revealed that greater thyroid dysfunction severity was associated with higher ultrasound grade in adolescent AITD patients. AITD is the most common thyroid dysfunction in adolescent age group patients residing in iodine sufficient areas. AITD is represented by HT and GD.[11] HT and GD are the most common causes of hypothyroidism and hyperthyroidism, respectively. In HT autoantibodies breakdown thyroid gland cells, resulting in thyroid destruction, whereas in GD, thyroid gland is stimulated by the autoantibodies against TSH receptor on follicular cells. The typical HT histological features include lymphoplasmacytic infiltration, germinal centre formation, follicular destruction, Hurthle cell change, and varying degrees of fibrosis.[12] while GD is characterized by histopathological hypercellularity, patchy lymphocyte infiltration, little colloid, and scalloping colloid.[13] Ultrasound is a valuable tool in the hand of radiologist for detailed analysis of thyroid gland. In normal thyroid gland, echogenicity is homogenous and is generally higher than the surrounding muscles. In AITD patients, characteristic US findings such as variable degrees of thyroid gland enlargement, decreased parenchymal echogenicity, and heterogeneous parenchymal echo pattern. Thyroid gland enlargement is usually diffuse and symmetric. HT may show as poorly defined, patchy hypoechoic areas and micronodular patterns consisting of multiple small (~ 2–6 mm) hypoechoic nodules. Tissue echogenicity of the thyroid gland on US depends on the organ's cellularity and vascularization.

Decreased colloid content, lymphocytic infiltration, and increases in intrathyroidal flow result in hypoechoic tissue patterns.[14] Heterogeneous echogenicity of the thyroid gland is another well-known finding in AITD.[15,16] Thyroid dysfunction can affect child and adolescent growth and development in various ways. Overt hypothyroidism can cause a potentially fatal medical condition with adverse effects on lipid metabolism and cardiovascular function. AITD, a single disease entity, can manifest in various thyroid function statuses. While subclinical and overt hypo- and hyperthyroidism share similar aetiologies, the symptoms of the former are nonspecific and signs are typically absent.[17] Our study clearly indicates that dysregulation in thyroid function tests correlates strongly with ultrasound characteristics. Ultrasound can be and should be used concurrently with thyroid function tests in case of children and adolescents with autoimmune diffuse thyroid disease.

CONCLUSION

In our study we found a clear association within hypo echogenicity and heterogeneity of thyroid gland and thyroid dysfunction in adolescent patients with AITD, including those with normal thyroid function, subclinical thyroid dysfunction, or overt thyroid dysfunction. These results clearly indicate that ultrasound can be used as supplement to biochemical tests in patients of AITD.

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