

The Study of the Thyroid Hormones Disturbance on Thyroid Morphology using Ultrasonography

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Abstract: *Thyroid function is the production of thyroid hormones which are created from thyroglobulin protein. The aim of this study to study the size and texture of thyroid gland with disturbance of T3, T4, TSH using ultrasonography. A descriptive study 309 patient were enrolled in the study with disturbance of T3, T4, TSH, in period from April/2015 up to February/2015 for patient referred for ultrasonic clinic to examine thyroid gland. The machine used in the study are Aloka 200 CD and Sonoscape with high frequency 7 – 10 MHZ left and right lobes were measured and detect echogenicity and size. Ultrasound findings of this study revealed that most age group affected due to this disturbance (25 – 50) 76.2%. The incidence of thyroid disease is more common in females 94.8% to 5.2% in males. The study revealed that the most endemic areas for thyroid diseases in Sudan are the west 40%. Most cases of thyroid changes were associated with increased thyroid hormone level with either complex or hypo echogenic texture.*

Keywords: texture, ultrasound, thyroid, hormone

1. Introduction

Because of the superficial location of the thyroid gland, high-resolution real-time gray-scale and color Doppler sonography can demonstrate normal thyroid anatomy and pathologic conditions with remarkable clarity. As a result, ultrasound plays an increasingly important role in the diagnostic evaluation of thyroid disease, although it is only one of several diagnostic methods currently available. [1].

The thyroid gland is located in the antero-inferior part of the neck (infrahyoid compartment) in a space outlined by muscle, trachea, esophagus, carotid arteries, and jugular veins (Fig. 1).

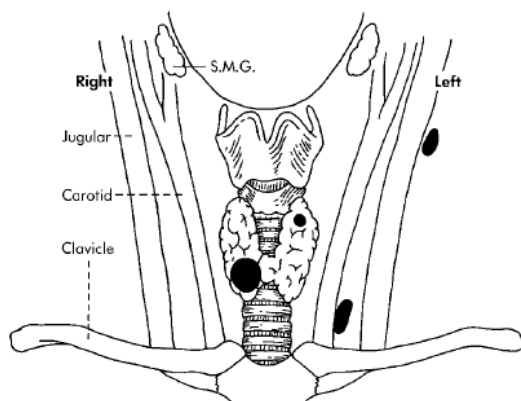


Figure 1: Cervical “map.” Such diagrams help communicate relationships of pathology to clinicians and serve as a reference for follow-up examinations; S.M.G., submandibular gland

The size and shape of the thyroid lobes vary widely in normal patients. In tall individuals the lateral lobes have a longitudinally elongated shape on the sagittal scans, whereas in shorter individuals the gland is more oval. In the newborn the thyroid gland is 18 to 20 mm long, with an anteroposterior (AP) diameter of 8 to 9 mm. By 1 year of age, the mean length is 25 mm and AP diameter is 12 to 15 mm. [2] In adults the mean length is approximately 40 to 60

mm, with mean AP diameter of 13 to 18 mm. The mean thickness of the isthmus is 4 to 6 mm. [3].

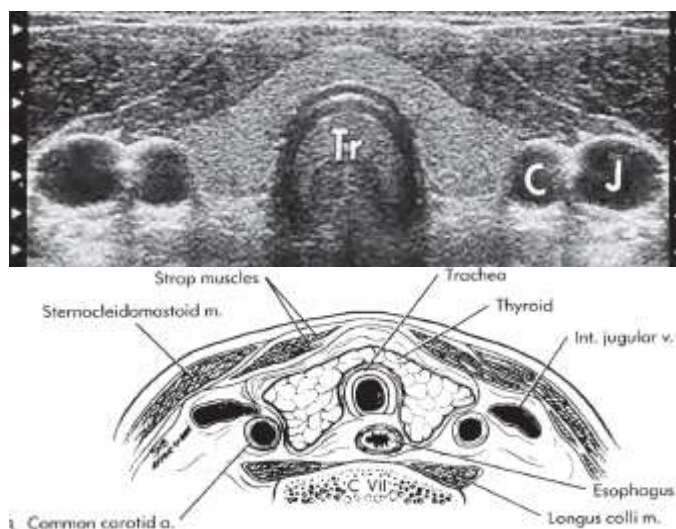


Figure 2: Normal thyroid gland

There were many pathologies that may affect the thyroid gland in different pattern of pathogenesis including the following: **Hyperplasia and Goiter:** Approximately 80% of nodular thyroid disease is caused by hyperplasia of the gland and occurs in up to 5% of any population. [17]. Its etiology includes iodine deficiency (endemic), disorders of hormonogenesis (hereditary familial forms), and poor utilization of iodine as a result of medication. When hyperplasia leads to an overall increase in size or volume of the gland, the term goiter is used. The peak age of patients with goiter is 35 to 50 years, and women are affected three times more often than men. Sonographically, most hyperplastic or adenomatous nodules are isoechoic compared to normal thyroid tissue, but may become hyperechoic because of the numerous interfaces between cells and colloid substance [5, 19]. Less frequently, a hypoechoic sponge-like or honeycomb pattern is seen.

Adenoma also 5-10% of nodular thyroid disease which is seven time common in female rather than male.⁵ Most result in no thyroid dysfunction; a minority (<10%) hyperfunction, develop autonomy and may cause thyrotoxicosis. Most adenomas are solitary, but may also develop as part of a multinodular process. The benign follicular adenoma is a true thyroid neoplasm, characterized by compression of adjacent tissues and fibrous encapsulation. Various subtypes of follicular adenoma include the fetal adenoma, Hürthle cell adenoma, and embryonal adenoma, each distinguished according to the type of cell proliferation.

Carcinoma: is one of the most important pathology that can sonographically identified and the ultrasound helps in determination of the pathology and its morphology relative to the component of the lesion in addition to assessing the vascular follow of the lesion also it can help in FNAC investigation as guidance. So Most primary thyroid cancers are of epithelial origin and are derived from follicular or para-follicular cells.¹⁶ Malignant thyroid tumors of mesenchymal origin are exceedingly rare, as are metastases to the thyroid. Most thyroid cancers are well differentiated, and papillary carcinoma (including so-called mixed papillary and follicular carcinoma) accounts for 75% to 90% of all cases. [16, 24]. In contrast, medullary, follicular, and anaplastic carcinomas (combined) represent only 10% to 25% of all thyroid carcinomas currently diagnosed in North America. For e.g. follicular thyroid carcinoma: sonographic features: Irregular tumor margins, Thick, irregular halo and Tortuous or chaotic arrangement of internal blood vessels. Diseases of the thyroid cause either underactivity or over activity of this gland. Underactivity of the thyroid results in hypothyroidism (also known as Hashimoto's thyroiditis) and goiter. Hypothyroidism can produce symptoms of weight gain, sensitivity to cold and brittle nails and hair. In Western countries, hypothyroidism is largely due to an autoimmune response, although iodine deficiency can also cause underactivity – which is largely in other parts of the world that lack iodized salt. Hypothyroidism is associated with several other diseases, including heart disease, type 1 diabetes, celiac disease and metabolic syndrome. Over activity of the thyroid is seen in Grave's disease, which results in bulging eyeballs, anxiety and sensitivity to heat among other symptoms. Enlargement of the thyroid can be the result of noncancerous goiter, which may or may not result in hypothyroidism or hyperthyroidism, or cancer. Radiation exposure, such as x-rays—especially in children—can affect thyroid status. Lab tests of TSH (thyroid stimulating hormone), T3 and T4 help in the diagnosis of thyroid conditions. Recent changes in screening guidelines that have a lower threshold limit of TSH hormone affects the thyroid status of millions of adults in the U.S. This has resulted in the diagnosis of many more patients with hypothyroidism. Lab results, symptoms and physical exam help direct physicians to the proper diagnosis and treatment of the thyroid.

2. Materials and methods

This study was descriptive study aimed to evaluate the thyroid hormone disturbance in thyroid gland ultrasound. In

periods from April 2015 – 2017 this study was conducted using linear probe with high frequency [7-10] MHz Aloka 200 SD and Sonoscape A5. At At Alamal Center in Khartoum Hospital & Eliskan Medical Center – Dar Assalam – Habib Alla Center, Alkalakla Alwihda. Using sagittal and axial plan the thyroid Left and right lobes were evaluated for the echogenicity.

3. Result and Discussion

Table 1: Showed the frequency distribution of age groups for patient

Age group	Frequency	Percent
9-19	11	3.6
20-30	62	20.1
31-40	82	26.5
41- 50	87	28.2
51-60	46	14.9
61-70	17	5.5
71-80	2	0.6
≥80	2	0.6
Total	309	100

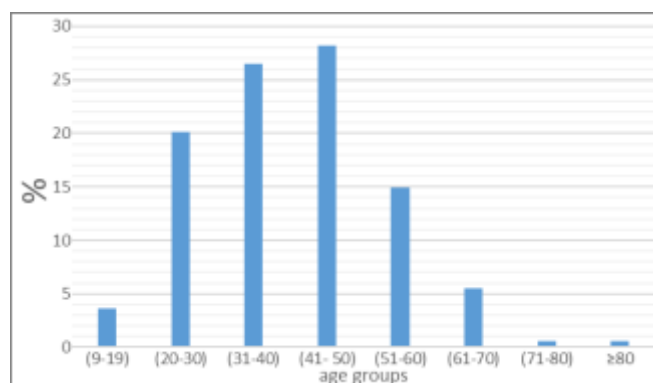


Figure 1: Bar graph showed the frequency Distribution of age groups for patient.

Thyroid gland is one of the most important gland in the body in which responsible for many metabolic and functional operation in various part of the body. This study intended to study the morphological disturbance of the gland using thyroid ultrasound in which the hormones were measured and the scan parameter and appearance were evaluated relative to the patient demographic data.

Age were the target also were the age were grouped into 8 major classes from 9-more than 80years to find the most affected age groups of this disturbance, where the most affect age range between 40-50yrs (78), accounted for 28.2%, followed by 30-40yrs (82) 26.5%. this indicate that the middle age of the patient life at higher risk of morphological change especially those with disturbed thyroid function. As in table (1) figure (1).

Table 2: Frequency distribution of gender among the selected study population

Gender	Frequency	Percent
Male	16	5.2
Female	293	94.8
Total	309	100

Female here is mostly affected by the morphological disturbance of thyroid texture and function in which accounted for 94.8% of study data were the male minimally incorporated into this effect. As in figure (2).

Thyroid hormone measured to ensure the presence of abnormal function relative to the normal one where TFT were done for 309 patients as in figure 3. There was increasing in level of T3, T4 and TSH for 126, 86, and 102 patients while decreased for 43, 58, and 152 patients where the rest of the patient was normal. Here a majority of people with disturbed TFT having hyperthyroidism in which the level of TFT as general increased especially the level of T3, and T4. From this point we need to correlate these finding with abnormality that could be detected using ultrasound.

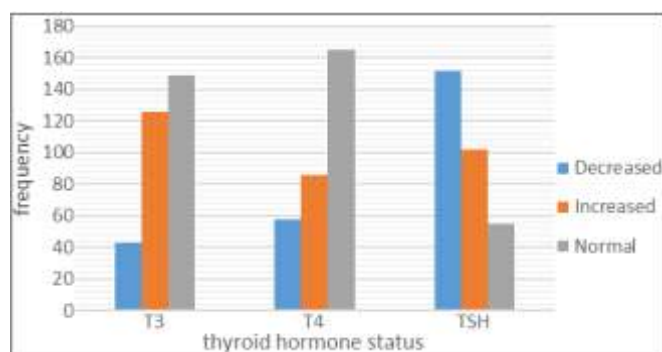


Figure 2: Demonstrate the frequency distribution of thyroid hormone status

Table 3: Showed the frequency distribution of residence

Residence	Frequency	Percent
Khartoum	96	31.06
West of Sudan	125	38.18
East of Sudan	11	3.6
White Nile	16	5.2
Algazera	22	7.1
Shamalia	26	8.4
Middle of Sudan	12	3.9
Blue Nile	1	0.3
Total	309	100

According to this study people from Khartoum state and west of Sudan was the major group accounting for 31.06% and 38.18% respectively. Regionally according the food habits this may explain the possibility of thyroid disturbance among these groups.

Table 4: Demonstrate the cross tabulation of thyroid hormone status and echogenicity of thyroid gland

	Complex			Isoechoic			Hyperechoic			Hypoechoic		
	T3	T4	TSH	T3	T4	TSH	T3	T4	TSH	T3	T4	TSH
Decrease	30	49	139	0	1	1	0	1	0	11	4	12
Increase	110	76	86	1	0	1	0	0	0	15	9	15
Normal	129	144	44	1	0	0	1	0	1	18	20	10
Total	269	269	269	2	1	2	1	1	1	37	37	37

A correlation intended to test the possibility of thyroid morphological changes was carried out, so the texture was complex, isoechoic, hyperechoic and hypoechoic echo

pattern in which the most of the patient came with either complex echotexture or hypoechoic echotexture, but related to the thyroid hormone status this texture is related to the increased T3 level in 110 patients and decreased of TSH level in 139 patients, where the T4 has no strong impact in this echo pattern. Hypoechogenicity as well related to the same hormones as 15 patients for T3 and 59 for TSH respectively.

But the volume of thyroid gland is mostly related to increment of T3 and T4 and decreased TSF for 98, 61 and 110 patients respectively as $p=0.991$.

As in table (5)

Table 5: Showed the cross tabulation between the size and echogenicity of thyroid US

Normal			Enlarged			Size Vs echogenicity
TSH	T4	T3	TSH	T4	T3	
42	17	9	110	41	25	Decrease
31	25	28	71	61	98	Increase
16	47	52	39	118	97	Normal
89	89	89	220	220	220	Total

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