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To study the role of ultrasonography in subclinical thyroid disorders

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Abstract
Objective: to assess the value of ultrasonography in evaluating the subclinical thyroid disorders.
Methods: In this study 50 patients with subclinical hypothyroidism and 50 patients with subclinical hyperthyroidism, were included those visiting Opd/Indoor wards of Guru Nanak Dev Hospital, attached to Government Medical College Amritsar. A written informed consent was taken from all the patients or the surrogates informer of the patients prior to including them in this study. Subclinical thyroid dysfunction was defined as normal serum free thyroxine (FT4) and free triiodothyronine (FT3) in the presence of high (subclinical hypothyroidism), or low-suppressed (subclinical hyperthyroidism) serum thyrotropin (TSH) levels. Ultrasonography thyroid examination was done by Radiology department. It was done by real time scanner, Esoate, Philips Enviser And Hd 11 Xe with multifrequency transducer curvillenear of 3.5 -5 MHZ and by linear probe of 5- 10 MHZ. The size, echogenecity, echotexture, nodules whether solitary or multinodular goitre were seen.
Results: The study population included 50 patients with subclinical hyperthyroidism and 50 patients with subclinical hypothyroidism in the age group of 20- 60 years. Subclinical thyroid disorders were seen more common between 31-60 years of age, and on ultrasonography thyroid size was increased by 14% in subclinical hyperthyroidism versus 4% sub clinical hypothyroidism, coarse echotexture was seen only in subclinical hypothyroidism, echogenecity was increased in 22% cases of subclinical hyperthyroidism, decreased in 30% cases of subclinical hypothyroidism whereas thyroid nodules were more common in subclinical hypothyroidism.
Conclusion: The study revealed that subclinical thyroid disorders were more common in the age group 31-60 years and it was 64% in age between 41-60 years. Subclinical hyperthyroidism was more common in males while subclinical hypothyroidism in females Thyroid size increases by 14% in cases of subclinical hyperthyroidism disorders and it was approximately normal in subclinical hypothyroidism while coarse echotexture were more common in subclinical hypothyroidism than hyperthyroidism.

Keywords: FT3 [Free thyroxine], FT4 [Free triiodothyronine], TSH [Thyroid stimulating hormone]

Introduction

Thyroid gland plays a pivotal role in tissue metabolism and development and in doing so affects various organs systems. The naming of thyroid gland is from Greek world thyreos means shield plus eidos means form, has been attributed to Wharton [1] in 1656, but an endocrine function was not proposed until almost 200 years later.

TSH secreted by the thyrotope cells of anterior pituitary stimulates thyroid hormone synthesis and secretion. TSH is released in a pulsatile manner and exhibits a diurnal rhythm, it is highest at night. However these excurtions are modest in comparison to those of other pituitary hormones, and TSH has a relatively long plasma half-life [50 min]. Consequently, single measurements of TSH are adequate for assessing its circulating level [2].

T3, T4 are synthesised under the effect of TSH so that T4 and T3 are stored in colloid within the follicles of the gland. They are released together, or some T4 is further deiodinated to T3 before release. A small but measurable amount of non TSH - dependent T4 secretion also occurs normally. Basically two major group of thyroid disorders are recognised:-

a) hyperthyroidism [overt or sub clinical]
b) hypothyroidism [overt and subclinical]

Subclinical thyroid disorders can be diagnosed by thyroid tests before symptoms and complications occur, are viewed as risk factors for developing hyperthyroidism and hypothyroidism complication. The goal of screening is to identify and treat patients with subclinical thyroid dysfunction before they develop complication.

Subclinical hypothyroidism [SCH] is defined as a state of increased serum TSH, with circulating T4 and T3 concentration within the population reference range. The incidence of SCH varies between 4 and 10% depending upon the gender, age and population studied [4]. SCH is common especially in older women. [upto 20%] in above the age of 60 yrs [5].

The thyroid gland is slightly more echo -dense than the adjacent structures because of its high iodine content. It has a homogenous ground glass appearance. Each lobe has a smooth globular shaped contour 3-4 cm in height, 1-5 cm in width, and 1 cm in depth. The isthmus is identified anterior to the trachea as a uniform structure that is approximately 0.5 cm in height and 2-3 cm in depth. The pyramidal lobe is not seen unless it is significantly enlarged. The surrounding muscles are of lower echogenicity than the thyroid and tissue planes between muscles are identifiable. The air filled trachea does not transmit the ultrasound. Surrounding blood vessels are echo- free unless they are calcified. There are frequently 1-2 mm echo free zones on the surface and within the thyroid gland that represent blood vessels. The vascular nature of all these echo free zones can be demonstrated by color Doppler imaging to differentiate them from cystic structures [6, 7].

Subclinical hyperthyroidism is characterised by a low TSH and nomal level of circulating thyroid hormones. The prevalence of subclinical hyperthyroidism is about 1% in men older than 60 yrs and 1.5% in women older than 60 years. Its overall prevalence in several large community and clinical surveys. Has been reported to range from 2-16% [8]. Current recommendations for the treatment of subclinical hyperthyroidism are to observe and monitor the pts with partial TSH suppression [0.1-0.4] but to treat the pts with complete TSH suppression [<0.1mlu/L [9, 10].

IN a cross sectional study of 4649 randomly selected adult subjects participants with decreased echogenicity [n=379] on ulrasound had a higher mean TSH [1.65Mu/L] compared with subjects with normal echogenecity [1.21Mu/L P<.0001].They demonstrated an association b/w hypo echogenicity on ultrasonography and higher level of TSH, suggesting decreased echogenicity as an early sign of throid dysfunction. Irregular echo pattern whether accompanied by hypoechogenicity or not, was another possible marker of thyroid failure, indicating use of US thyroid in detecting early and sub clinical thyroid disorders [11].

Compared with control patients, a greater proportion of patients with subclinical hypothyroidism and patients with subclinical hyperthyroidism had marked color flow Doppler sonography pattern [78% vs 15% [P<0.001] and 53% vs 15% [p<0.001] respectively [12, 13]. Ultrasonography may detect non-palpable nodules cysts, will estimate nodule and goiter size, will monitor the changes following therapy and will guide the fine needle aspiration biopsy. After the induction of ultrasonography it has become clear that nodules in thyroid gland are very prevalent ranging from 17% to 60% if older people are included in the study [14]. Hypoechogenicity, micro-calcification, indistinct borders, increased nodular flow [visualised by Doppler study] may have predictive value in distinguishing malignant from benign nodules [even in multinodular goiter]. The normal echogenicity represented normofollicular or macrofollicular tissue structure, while a hypoechogenicity pattern represented a microfollicular or solid structure in pts with chronic autoimmune throditis [15].

IN a study to evaluate the correlation of normal US with the thyroid tests, a total of 681 individuals were enrolled. Individuals were separated into two groups as normal [group 1] and hypoechoic [group 2] according to echogenicty on US. Subjects with nodular thyroid lesions were excluded from the study. TSH, free t4, [ft4], thyroid peroxidise antibody and anti-thyroglobulin antibody values were recorded in both groups and thyroid stimulating hormone receptor antibody was recorded in individuals with low TSH. The result was 86.1% of individuals in group [1] had normal TSH, 93.7% had normal thyroid antibodies and in 77.6% of individuals all thyroid tests were normal. In the 6, 9% of group [2], all reviewed thyroid tests were normal [16].

Material and Methods

The study was conducted in 50 [sub clinical hyperthyroidism and 50 hypothyroidism visiting OPD /INDOOR medical wards of Guru Nanak Dev Hospital atttched to Government Medical College Amritsar. All these patients were then evaluated under the following protocol:

Detailed history, complete physical examination routine lab test like, Hb, TLC DLC, PBF, liver function test, renal function test, ecg, fasting blood glucose, thyroid profile, ultrasonography of thyroid gland and thyroid function test like FREE t3, FREE t4. TSH was done in a fasting state by Enzyme Immunoassay.

Inclusion criteria

Patients of Sub Clinical Hyperthyroidism
Patients of Sub Clinical Hypothyroidism

Exclusion criteria

- Patients of Overt Hyperthyroidism
- Patients of Overt Hypothyroidism
- Age <20 Years and >60 Years
- Patients on Thyrotoxic Drugs
- Patients on Drugs like Lithium, Amiodarone
- Pregnancy

Results

It was seen that 91% of sub clinical thyroid disorders were seen between age 31- 60 years of age and it was more common in elderly people.

Table 1: Showing Age Distribution in Subclinical Thyroid Disorders.

Age	Subclinical hypothyroidism	Subclinical hyperthyroidism	Total
<=30	5[10%]	4[8%]	9
31-40	14[28%]	13[26%]	27
41-50	19[38%]	26[2%]	45
51-60	12[24%]	7[15%]	19
Total	50	50	100

In gender wise distribution it was seen that subclinical thyroid disorders were more common in female ie 70% with significant statistical value p of 0.029.

Table 2: Assessment of thyroid size in sub clinical thyroid gland disorders

Thyroid size	Subclinical hypothyroidism	Subclinical hyperthyroidism	Total
Normal	48[96%]	43[76%]	91[91%]
Increased	2[4%]	7[14%]	9[9%]
Total	50	50	100

Above table and graph show coarse echotexture was seen in 20% cases of subclinical hypothyroidism and normal in all cases of subclinical hyperthyroidism

It was also observed that in subclinical thyroid disorders, 74% patients have homogenous echogenicity and decreased echogenicity in 15% of subclinical hypothyroidism and

increased echogenicity in 11% of subclinical hyperthyroid disorders with significant statistical p value < 0.001

Table 3: Assessment of Echotexture

Echogenecity	Subclinical Hypothyroidism	Sub Clinical Hyperthyroidism	Total
Decreased	15[30%]	-	15
Homogenous	35[70%]	39[78%]	74
Increased	-	11[22%]	11
Total	50	50	100

It was also seen that thyroid nodule either single or multi were seen in 14% cases of subclinical hyperthroidism and were very rare i e, 2% in subclinical hypothroidism with significant statistical value of p less than 0.045.

BMI was increased in 44% cases of subclinical hypothyroidism and there was decrease in BMI in 32% cases of subclinical hyperthyroid disorsers with significant p value less than 0.001.
Pulse rate was also increased in 46% cases of subclinical hyperthyroid disorders and was decreased in 34% cases of subclinical hypothyroidism with p value less than 0.001.
Systolic blood pressure was increased ie, 131.96+/- 9.89 in subclinical hyperthyroid disorders and it was normal ie 126.40+/_15.56 mm of Hg in hypothyroid cases with p value < 0.035.
It was also observed that normal DBP was there in all cases of subclinical thyroid disorders with statistical value of 0.053.
With increase in TSH there was increase in BMI with significant p value < 0.001

Table 4: Showing Bmi and P Value in Subclinical Thyroid Disorders.

	BMI			P value
	Decreased [=16]	Normal [n=62]	Increased [n=22]	
Tsh[mean+/-SD]	0.09+/-0.10	3.49+/-4.81	10.79+/-7.61	,0.001

There was increase in BMI of 10.79+/-7.61 in sub clinical hypothyroIdism with significant statistical p value less than 0.051
And there was decrease in pulse rate of 11.36+/-8.57 in subclinical hypothyroidism with P value<0.048 and there was increase in pulse rate of 0.15+/-0.12 in subclinical hyperthyroidism with p value <0.001.

Discussion

Subclinical disorders are very important thyroid abnormalities which usually are under diagnosed because patients are usually asymptomatic and have very subtle symptoms. Ultrasonography can be of much value in such cases. The findings of ultrasonograohy can help in subclinical disorder, can help in treating such cases and preventing progression to overt thyroid disorders
In our study ultrasonography of thyroid in subclinical thyroid disorders were compared with sign/symptoms and other tests. Very few studies have been done to study the correlation of ultrasonography of subclinical thyroid disorders and thyroid enzyme and various clinical features of these disorders. In our study [50] subclinical hypothyroidism and 50 Subclinical hyperthyroid disorders were takn as group 1 and group 2 respectively. According to Baloch, Z, Fatourechi, V, the incidence of SCH vareis between 4-10%, depending upon the age, gender and population study [4] Subclinical hypothyroidism is common, especially in older women, overall prevalence is 4-10% in general population and upto 20% in women above of 60 years [5]. In our study we found 91% of subclinical thyroid disorders were seen between age group 31-60 years, out of this 90% of sub clinical hypothyroidism and 92 % of subclinical hyperthyroidism were seen in this age group.70% of subclinical thyroid disordes were present in female and 30% in males. In females, 57% of cases were subclinical hypothyroidism and 43%of cases were subclinical hyperthyroidism, whereas in males 34% of cases were subclinical hypothyroidism and 66% of cases were subclinical hyperthyroidism. [p value of 0.029]. As we compare our study with Baloch, Z *et al* both studies show similar results of subclinical hypothyroidism is being more common in older women.

On ultrasonography of thyroid, thyroid size was increased in 9% of cases of subclinical thyroid disorders out of which 77% were subclinical hyperthyroidism and 23% were subclinical hypothyroidism. No study is available in literature for comparative analysis.
In a study done by Tajtakova M *et al*, in female of 20-60 years it was found that average thyroid gland volume was 13.1+/-7.3 ml. Women upto 40 years of age had smaller thyroid glands than older patients. Large goiter were present only in patients older than 40.Homogenous and appropriate echogenicity was present in 71%. 21.5 % had decreased or decreased and inhomogenous echogenicity. 5.8% had a solitary nodule in thyroid gland all of them being over 40 years, multinodular goiter was present in 1.7% [17].
In our study on ultrasonograohy of thyroid examination coarse echotexture was present in 10%of subclinical thyroid disorders in which all cases were of subclinical hypothyroidism. In subclinical hyperthyroidism echotextuer of thyroid was normal in all cases. So coarse echotexture thyroid was more common in subclinical hypothyroidism in our study it was seen that on ultrasound thyroid, 74%of subclinical thyroid disorders had homogenous echogenicity which is near about similar to above Tajtakova M *et al*, study showing homogenous echogenicity in 71% cases. 15% of cases had decreased echogenicity with significant p value of < 0.001[all cases subclinical hypothyroidism.] As compared to above study which show 21.5% cases having decreased echogenicity, our study showed that multinodular goiter was common in woman older than 40 years of age and 11% of cases had increased echogenicity in cases of sub clinical hyperthyroidism.
In our study single thyroid nodule was present in 4% cases as compared to Tajtktova M *et al* which show 5.8% with significant p value of 0.045, multinodules in 3% as compared to above study which show multinodular goiter in 1.7%with significant p value 0.045 and colloid cyst in 1% cases of subclinical thyroid disorders. Mostly 7% of these nodules either single or multiple were present in subclinical hyperthyroidism and 1% in subclinical hypothyroidism.
62% of sub clinical thyroid disorders had normal BMI, 16% had decreased BMI in subclinical hyperthyroidism and 22% had increased BMI in subclinical hypothyroidism in

subclinical hypothyroidism. There was increase of BMI of [mean +/- Sd] 10.79+/- 7.61 which was similar to Gaurav Gupta *et al* [18] study with significant p value<0.001. In subclinical hyperthyroidism there was decrease of BMI of 0.09+/- 0.10 with p value <0.001

Table 5: Comparison of Our Usg Thyroid Findings with Findings Seen In Study by Tajtakova *Et Al*

	Tajtakova *et al* study	**Our study**	**p- value**
Homogenous echogenicity	71%	74%	<0.001
Decrease echogenicity in sub clinical hypothyroid pt	21.5%	15%	<0.001
Increase echogenicity in sub clinical hyperthyroidism	-	11%	<0.001
Solitary nodule	5.8%	5.8%	0.045
Multinodular goiter	1.7%	1.7%	0.045

Table 6: Comparison of Features of Sub Clinical Thyriod Disorders with Our Study

	Maore E *et al*	**Gaurav Gupta *et al***	**Saima Af Zal *et al***	**Tajtakova M *et al***	**Our study**
BMI IN SCH	-	Increased	-	-	Increased
PR IN SCH	Decreased	-	-	-	decreased
PR IN SC Hyper	Increased	-	-	-	increased
Effect of SCH on SBP	-	-	-	No significant effect	No significant effect
Goiter	-	-	-	More in females above 40 years	More in females above 40 years

Conclusion

In our study 50 subclinical hypothyroidism and 50 subclinical hyperthyroidism were taken between ages 20-60 yrs of age. Pts with overt hypo /hyper thyrodisim were excluded. Similarly patients on thyrotoxic drugs, amiodarone, lithium and patients which were pregnant were excluded. Then thyroid ultrasonic findings were correlated with subclinical thyroid disorders.

Subclinical thyroid disorders were common with age 31-60 yrs.It was 64% in age group of 41-60 yrs. So subclinical thyroid disorders were common in elderly people. Subclinical hypothyroidism were more common in the females and subclinical hyperthyroid disorders were common in males. Thyroid size increases in subclinical hyperthyroidism in 14% cases and it was approximately normal in subclinical hypothyroidism. Coarse echotexture of thyroid was seen in subclinical hypothyroidism. Echotexture was normal in cases of subclinical hyperthyroidism. Echogenicity of thyroid was normal in most cases of sub clinical thyroid disorders, increased in 22% cases of subclinical hyperthyrodisim and decreased in 30% cases of subclinical hypothyroidism. Thyroid nodules were common in cases of sub clinical hyperthyroidism and in subclinical hypothyroidism cases nodules were very rare. BMI was found to be increased with increase of TSH and decreases with decrease of TSH.

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