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Research Article

A Hospital based study on Thyroid Dysfunction based on estimation of TSH & Thyroid Hormones

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Abstract: Thyroid dysfunction is slowly taking an epidemic form, only after Diabetes Mellitus. Since thyroid dysfunction adversely affects body's metabolism, and increases the risk of cardiovascular disease, it has become imperative to evaluate the cause of increasing prevalence of Thyroid disorders in this post-iodization era. As a first step, this prospective observational study was undertaken in Central Clinical Laboratory, Gauhati Medical College & Hospital to get an approximate picture of the prevalence of thyroid dysfunction in this North Eastern Corner of India. The aim of the study was to evaluate i) the prevalence of abnormal thyroid function and ii) the relationship between abnormal thyroid function and lipid levels. The study was planned as a prospective observational study. All the thyroid reports generated from processing of samples of hospital admitted patients were analyzed and data of abnormal thyroid hormone reports collected. Lipid profile reports of the patients with abnormal thyroid reports were also recorded. In results thyroid Function Test was done on 17323 samples during the one year period of study. Analysis of the reports presented thyroid dysfunction as 21.05% with a female preponderance. Subclinical Hypothyroidism was 13.64% followed by Subclinical Hyperthyroidism, 4.72%. Incidence of subclinical hypothyroidism was found to be more in females and in lower age groups while subclinical hyperthyroidism in higher age groups. In conclusion the presentations of thyroid disorders are non-specific and undiagnosed thyroid disorder increase the risk of cardiovascular disease. So screening for thyroid disease should be routinely performed in the young population for early diagnosis and treatment.
Keywords: Hypothyroidism, Hyperthyroidism, Lipid Profile, Thyroid Stimulating Hormone

INTRODUCTION:

Thyroid disorder is a worldwide public health problem. It has taken an epidemic form, only after diabetes mellitus. It is a spectrum of disorders which manifests either as hyperthyroidism or hypothyroidism. Based on thyroid hormone levels and presence or absence of symptoms they may again be sub classified as overt or subclinical.

The prevalence of thyroid dysfunction varies in different parts of the world. Studies conducted in different countries have put forward different prevalence estimates. The Framingham Study showed that 13.6% of US women older than 60 years had TSH levels greater than 5mU/L [1] .In Italy serum TSH levels greater than 5mU/L, were found in only 1.5% of similarly aged women [2].

More and more Indians are suffering from thyroid disorders. An overall estimated 42 million Indians are suffering from thyroid disorders [3]. Abnormal thyroid function has important public health consequences. Studies have shown suppressed TSH levels to be associated with decreased bone density [4, 5], an increased risk of atrial fibrillation [6] and premature atrial beats [7]. It has been known for decades that overt hypothyroidism contributes to elevated serum cholesterol levels [8], and recent studies suggest that this may also be true with subclinical hypothyroidism [9]. However, due to lack of definite laboratory guidelines to classify overt and subclinical thyroid disorder, the impact of various degrees of thyroid dysfunction remains unsettled.

Estimation of thyroid hormones and TSH are fundamental in arriving at a diagnosis of thyroid dysfunction. Taking this into consideration this study had been planned with an aim to find out the prevalence of thyroid disorders in hospital admitted patients based on their thyroid profile reports. The prevalence of thyroid dysfunction as reflected by their abnormal thyroid hormone levels would by and large reflect the prevalence of thyroid dysfunction in the society.

The aim of the study was to evaluate i) the prevalence of abnormal thyroid function and ii) the

relationship between abnormal thyroid function and lipid levels.

MATERIALS & METHODS:

Study Design:

This study was planned as a prospective observational study to be conducted in Biochemistry Section of Central Clinical Laboratory of Gauhati Medical College & Hospital for a period of one year, from February 2014 to January 2015. Gauhati Medical College & Hospital is a tertiary level referral hospital which caters to the population of Lower Assam and attends to 1747(approx.) patients daily with an average of 235(approx.) daily admissions.

Inclusion Criteria: The thyroid reports generated in the laboratory were included in the study.

Exclusion Criteria: The reports of ICU patients and hemolysed samples were excluded from the study.

Serum Assays:

Samples were collected at the sample collection centre and centrifuged promptly. All the clear non-hemolysed samples were selected and processed within 2 hours of collection. Age was not a factor and reports of patients of all ages were included in the study. Thyroid Function tests were done on serum samples in Vitros 5600 Integrated System and EciQ Immunodiagnostic System using the enhanced chemiluminescent technique. Lipid profile was done in fasting samples using dry slide technology of Vitros5600 Integrated System and Vitros 4600 Chemistry System. Both Internal and External Quality Controls were run on a regular basis to ensure the accuracy of the test results.

Data Collection:

The samples were tested in the Central Clinical Laboratory. All the thyroid reports thus generated were analysed and data of abnormal thyroid hormone reports collected and recorded on a daily basis. Lipid profile reports of the patients with abnormal thyroid reports were also recorded. A particular regarding the patients name, age, sex, location and disease he/she was suffering from was collected from the requisition form sent to the laboratory along with the blood sample. On the basis of the reports, the thyroid status was defined as follows [10]:

Condition	TSH	Thyroid hormones
Overt hyperthyroidism	<0.1mIU/L	Elevated T4 or T3
Overt hypothyroidism	>4.5mIU/L	Low T4
Subclinical hyperthyroidism	TSH<0.1mIU/L	Normal T4 and T3
	0.1mIU/L<=TSH<0.4mIU/L	Normal T4 and T3
Subclinical hypothyroidism	4.5mIU/L<TSH<10mIU/L	Normal T4
	TSH>=10mIU/L	Normal T4

Age wise and sex wise distribution of thyroid disorders was found out.

Data Analysis:

The data thus collected was analysed statistically. Measures of significance between groups in relation to lipid profile data was calculated using the Analysis Of Variance (ANOVA).

RESULTS & OBSERVATIONS:

Out of the 17323 number of TSH done in the 1year study period, 13,677(78.95%) was found to be in the normal range, 2569(14.83%) was found to be elevated and 1077(6.22%) was below the reference range.

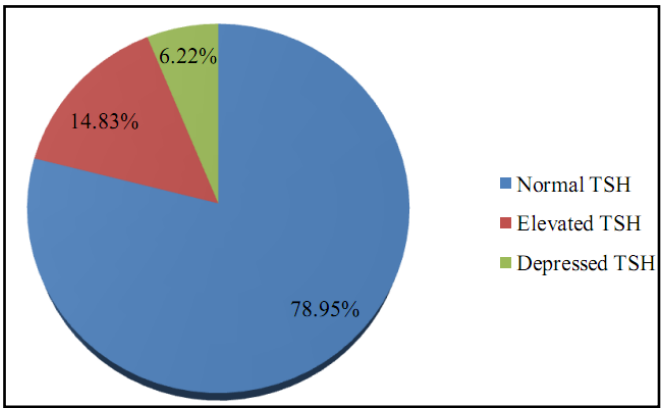

Fig- 1. Percentage of normal, depressed and elevated TSH reports.

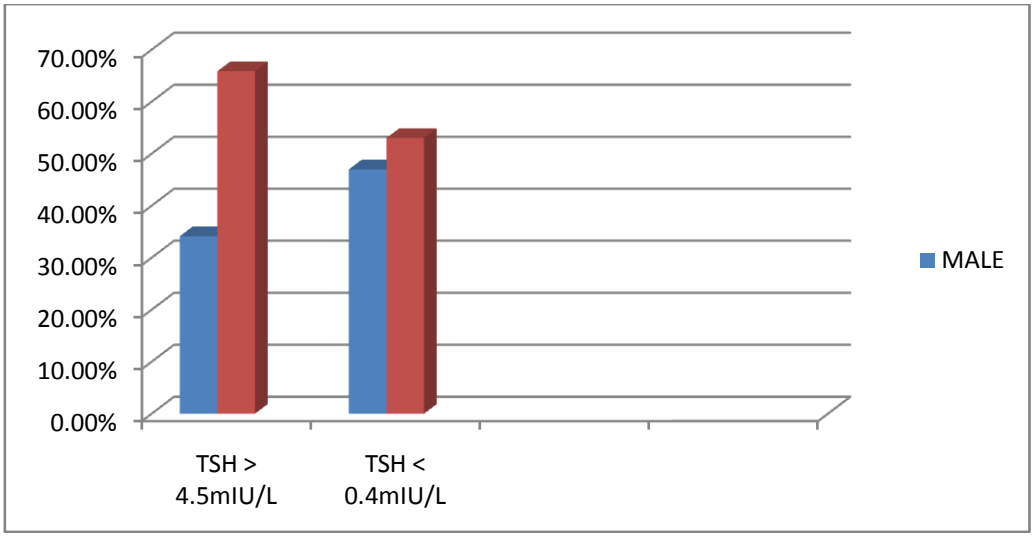

Fig - 2. Genderwise distribution of outside normal range TSH reports.

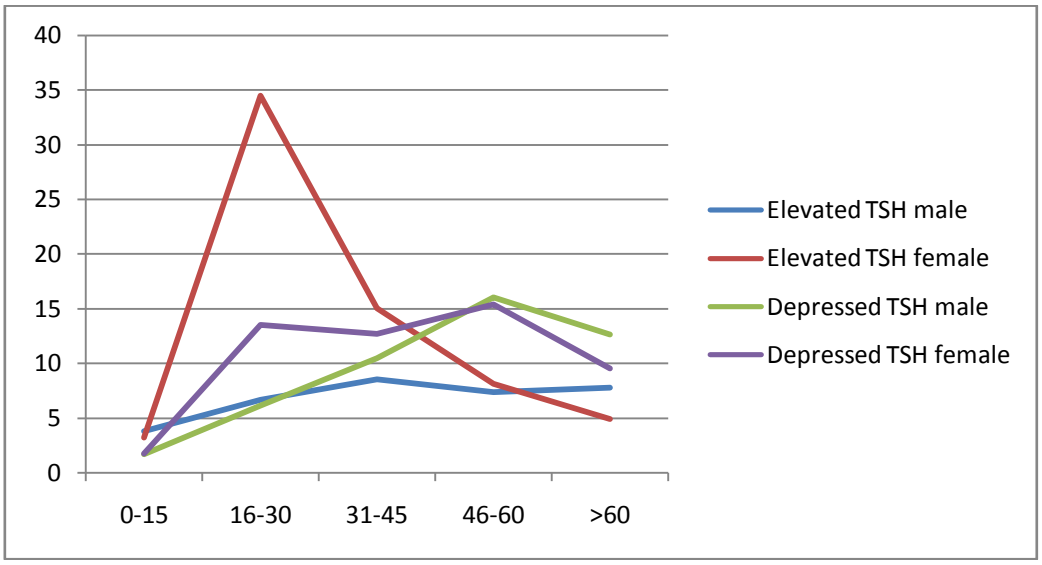

Fig 3 : Studying the age distribution of outside normal range TSH reports .

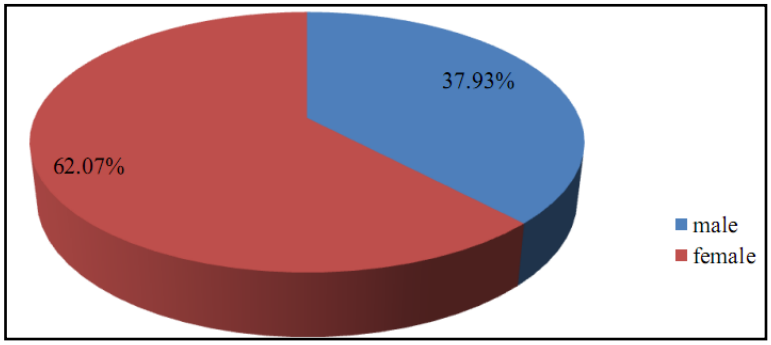

Fig 4 : Showing genderwise prevalence of thyroid dysfunction.

Study of genderwise prevalence of thyroid dysfunction showed that 62.07% of the thyroid dysfunction detected on basis of the thyroid reports was found in females and 37.93% in males, thereby showing that incidence of thyroid dysfunction was more in females than males

Table 5: Prevalence of thyroid abnormalities

Thyroid Status	No. of subjects
Total subjects	17323
Euthyroid	13677(78.95%)
Hypothyroid	206(1.19%)
Subclinical Hypothyroid	2363(13.64%)
Hyperthyroid	260(1.5%)
Subclinical Hyperthyroid	817(4.72%)

Table 6: Sex wise distribution of different types of thyroid dysfunction

Type of thyroid dysfunction	Subclinical Hypothyroid	Hypothyroid	Subclinical Hyperthyroid	Hyperthyroid	TOTAL
Male	837(22.96%)	40(1.10%)	390(10.7%)	116(3.18%)	1383(37.93%)
Female	1526(41.85%)	166(4.55%)	427(11.71%)	144(3.95%)	2263(62.07%)
Total	2363(64.81%)	206(5.65%)	817(22.41%)	260(7.13%)	3646

Table 7 : Agewise distribution of different types of thyroid dysfunction

		Age group(in	Years)			
Type of thyroid dysfunction	0-15	16-30	31-45	46-60	>60	Total
Subclinical Hypothyroidism	172(4.72%)	1027(28.17%)	547(15%)	346(9.49%)	271(7.43%)	2363(64.81%)
Hypothyroidism	8(0.22%)	30(0.82%)	60(1.65%)	52(1.43%)	56(1.54%)	206(5.65%)
Subclinical Hyperthyroidism	32(0.88%)	134(3.68%)	189(5.18%)	265(7.27%)	197(5.4%)	817(22.41%)
Hyperthyroidism	5(0.14%)	78(2.14%)	61(1.67%)	74(2.03%)	42(1.15%)	260(7.13%)
Total	217(5.93%)	1269(34.81%)	857(23.51%)	737(20.21%)	566(15.52%)	3646

Table 8: Mean Lipid Levels by Disease State

Disease State	Total Cholesterol, mg/dl (mmol/l)†	LDL Cholesterol,* mg/dl (mmol/l)	HDL Cholesterol,* mg/dl (mmol/l)	Triglycerides, mg/dl (mmol/l)‡
Hypothyroid	183.31(4.7)	104.11(2.7)	40.46(1.0)	134.15(1.5)
Subclinical Hypothyroid	171.72(4.4)	98.98(2.6)	37.75(1.0)	169.34(1.9)
Subclinical Hyperthyroid	151.14(3.9)	85.54(2.2)	43.56(1.1)	125.94(1.4)
Hyperthyroid	165.74(4.3)	96.32(2.5)	37.40(1.0)	129.96(1.5)

*LDL indicates low density lipoprotein; HDL indicates high density lipoprotein.

† P-value= 0.0310, considered significant.

‡ P-value < .01, considered very significant.

Table 9: Mean Lipid Levels By Sex.*

DISEASE STATE				
Lipid level	Hypothyroid	Subclinical Hypothyroid	Subclinical Hyperthyroid	Hyperthyroid
Total Cholesterol				
Women	187(4.8)	180.03(4.7)	157.2(4.1)	175.14(4.5)
Men	180.44(4.7)	163.52(4.2)	146.53(3.8)	155.62(4.0)
LDL Cholesterol				
Women	115.71(3.0)	99.16(2.6)	90.27(2.3)	103.47(2.7)
Men	90.5(2.3)	98.06(2.5)	82.38(2.1)	88.62(2.3)
HDL Cholesterol				
Women	42.14(1.1)	36.77(0.9)	35.81(0.9)	46(1.2)
Men	38.5(1.0)	38.7(1.0)	38.53(1.0)	40.93(1.0)
Triglyceride				
Women	146.57(1.65)	175.33(2.0)	145.21(1.6)	128.71(1.45)
Men	119.67(1.35)	163.58(1.85)	112.11(1.3)	131.31(1.5)

*Values are in milligrams per deciliter (millimoles per liter).LDL indicates low-density lipoprotein; HDL, high-density lipoprotein.

DISCUSSION:

In the present study an attempt was made to assess the scenario of thyroid dysfunction in this north eastern corner of India from the analysis of thyroid function test reports generated in Central Clinical Laboratory, Gauhati Medical College Hospital.

Of the total 17323 TSH test done in the 1 year period of study abnormal TSH was observed in 21.05% of the subjects. Elevated TSH values were found in more number of subjects than depressed values (14.83% vs 6.22%). This is consistent with the percentage of elevated TSH found in other studies in an iodine replete population (11-14). TSH elevation showed a female preponderance. 65.86% of elevated TSH reports were of females and 34.14% of males. Distribution of depressed TSH values were almost similar in males and females,(46.98% and 53.02%). Turnbridge et al.; found that 7.5% of women and 2.8% of men of all ages in Wickham, England had serum thyrotropin (thyroid stimulating hormone, TSH) levels greater than 6mU/L [11]. Although deranged TSH level was seen in reports of all age groups but the percentage was high in 16-30 years age group(34.81%). 83.29% of patients in this age group having deranged TSH values had elevated levels. The high percentage of thyroid dysfunction in this age group is because of the large number of thyroid function test requests received from labour room and antenatal cases in this age group. Thyroid function tests done in young females have resulted in early detection of the high prevalence of thyroid dysfunction in young pregnant females. In a multi-centric epidemiological study conducted across eight Indian cities the prevalence of undetected hypothyroidism was found to be 3.47% i.e. almost one-third of the hypothyroid patients were diagnosed for the first time during the course of the study related screening [15]. In the Colorado Thyroid Disease Prevalence Study 10% of subjects not taking thyroid medication had thyroid abnormality which was detected because of testing [16]. This calls for thyroid screening tests in young population for early detection of thyroid dysfunction. Depressed TSH level was found to be high in this study in both males and females in the age group of 46-60 years.

In the present study thyroid dysfunction (based on deranged TSH levels) was found to be prevalent more in females than in males, 62.07% of affected individuals were females while 37.93% were males. Studying the type of thyroid dysfunction based on TSH&TT4/TT3 reports, subclinical hypothyroidism was found to be the major type of thyroid dysfunction, (13.64%), followed by subclincal hyperthyroidism, (4.72%). In a similar hospital based study on patients in Subharti University, thyroid dysfunction was found to be 10.8%, hypothyroidism was reported in 7.7% and hyperthyroidism in 3.1% 17. Similar findings were reported in other studies, where subclinical hypothyroidism was found in 8.73% of females as compared to 7.17% of males [15].

Studying the age distribution of thyroid dysfunction, percentage was highest in the age group of 16-30 years. This as mentioned earlier was because of the high number of thyroid function tests requests received from labour room and antenatal cases of this age group. Human Chorionic Gonadotrophin (HCG) and Estrogen are the two main hormones responsible for the change in thyroid physiology observed during pregnancy. In contrast to hyperthyroidism which is found in 2/1000 pregnancies 18, hypothyroidism is quite common in pregnancy [19] and the incidence of subclinical hypothyroidism is at least 2.5%. In this study the next age group having high percentage of thyroid dysfunction was 31-45 years. In all the age groups subclinical hypothyroidism was the most common type of thyroid dysfunction. The highest number of subclinical hyperthyroid was found in the age group of 46-60 years followed by > 60 years age group. Therefore in this study it was observed that subclinical hypothyroidism was found to be more prevalent in younger age groups while subclinical hyperthyroidism in older age groups. In the hospital based study at Subharti University 30-45years age group had the highest prevalence of thyroid dysfunction17. In the multicentric study conducted across eight Indian cities predominance of thyroid dysfunction was found in women especially that in mid-life (46-54 years). In a study conducted at a tertiary care teaching hospital in Kolkata, hypothyroidism was reported to be more prevalent in women (40.5%) in the age group of 36-45years [20], while in another study thyroid dysfunction was reported to be more prevalent in 34years above individuals [21]. The samples received in the below 15 years age group in this study was mostly of neonates, and subclinical hypothyroidism was the major type of thyroid dysfunction observed in this age group.

Mean serum lipid concentrations are presented according to the disease state in table 8. The trends across disease states for mean total cholesterol and triglyceride were found to be statistically significant (p-value 0.0310, and .0064 respectively). LDL cholesterol level was high in women than in men across all disease states. This contributed to their higher total cholesterol levels. Thyroid status may be a factor as there were more women than men with high TSH levels. Serum total cholesterol and LDL cholesterol was seen to rise with declining thyroid function. Triglyceride level was however not found to increase with increasing TSH levels, which is in accordance with the findings of other investigators [22, 23, 24].

India has been classified as having "optimal" iodine nutrition by a WHO assessment of global iodine status conducted in 2004 [25, 26]. But prevalence of hypothyroidism in adults is still very high in India with thyroid disorders not confined to iodine deficient sub-himalayan zone but also extending to the fertile plains. In a study conducted across 8 cities, Kolkata recorded the highest prevalence of hypothyroidism (21.67%) 15. Increased use of pesticides and other chemicals in agriculture may be responsible for the increase in thyroid disorders. This calls for further research. Also proper monitoring of the salt iodization program is required.

Thyroid disease affects almost every aspect of health. The presentation of thyroid disorders are non-specific and only biochemical estimation of TSH can confirm the diagnosis. TSH measurement is recommended in relevant cases (having suggestive symptoms) and population at risk like pregnant women to prevent serious maternal and fetal outcome [27].

Some limitations of this study:

The study was based on the analysis of reports of hospital admitted patients. The medical condition of these patients may affect their thyroid status. Moreover the newly diagnosed and already diagnosed cases on thyroid medication were subjected to the same study protocol. TT4 value was taken into consideration to determine the type of thyroid dysfunction. TT4 concentration may have been slightly elevated because of increase in thyroid hormone binding proteins in patients who were receiving certain concomitant medicines eg. Estrogen.

However the strength of this study was the great amount of thyroid report data which was available. In the one year period of study 17323 TSH, 1465 TT4, 1352 TT3 was done. Analysis of this enormous amount of data was thought to give us an approximate picture of thyroid dysfunction in the society at large despite the limitations.

CONCLUSION:

This study was undertaken with an objective to get a generalized idea of the state of thyroid dysfunction in the population residing in this north-eastern part of the country. The subjects were all indoor patients and in most of the cases thyroid test was advised in preparation for some kind of surgical intervention. The study revealed that the percentage of thyroid dysfunction was high with subclinical hypothyroidism being the main type of thyroid dysfunction and showing a female preponderance. While subclinical hypothyroidism was found more in younger age groups, subclinical hyperthyroidism was more prevalent in elderly age groups. More samples of females in the age group of 16-30 years gave a higher percentage of thyroid dysfunction, mainly subclinical hypothyroidism in this age group .Total cholesterol and LDL cholesterol was observed to rise with corresponding decrease in thyroid function. As several studies have linked hyperlipidemia with cardiovascular morbidity, evaluation of thyroid status could help in early detection and treatment to prevent serious complications associated with these disorders.

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