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Study of TSH Levels in Subjects with and Without Metabolic Syndrome

KEYWORDS: metabolic syndrome, thyroid, thyrotropin stimulating hormone

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ABSTRACT *Background: Metabolic syndrome (MetS) refers to a cluster of features conferring the risk for cardiovascular disease and type 2 diabetes mellitus. Considering the fact that the thyroid dysfunction is also associated with the risk for CVD, this study was undertaken to estimate the levels of thyrotropin stimulating hormone (TSH) in subjects with and without metabolic syndrome.*

Materials and Methods: The study population included 50 subjects with metabolic syndrome and 50 subjects without metabolic syndrome. Blood pressure and anthropometric measurements were measured in all the study subjects, following which a fasting blood sample was obtained for the estimation of fasting blood sugar (FBS), lipid profile and TSH. The data obtained was analyzed using SPSS software. AHA/NHLBI definition was used to define MetS. The values obtained were compared using student t test and correlated using Pearson correlation.

Results: TSH levels were high among the subjects with MetS and it was statistically highly significant (<0.01). Pearson's product-moment correlation of TSH with age and the components of the MetS yielded a positive and highly significant (<0.01) correlation with age, FBS and waist circumference (WC). It also significantly correlated with triglyceride (TGL) (<0.05). The prevalence of hypothyroidism in MetS was 46% and the hyperthyroidism was 6%.

Conclusion: High TSH was found to be associated with metabolic syndrome, suggesting that hypothyroid subjects are prone for cardiometaboilc risk.

INTRODUCTION:

The metabolic syndrome (MetS) is a cluster of visceral obesity, dyslipidaemia, hyperglycaemia, and hypertension. MetS increases the tendency to develop type 2 diabetes mellitus (T2DM) and coronary heart disease (CHD). (1) Recent studies are showing that thyroid dysfunction is increasingly found in the diabetes mellitus patients (2) Studies have also shown that thyroid illness patients are also at risk for CHD risk. (3) Thus, thyroid dysfunction can escalate the risk of CHD in MetS patients and subjecting them for screening with thyroid profile becomes important for early intervention. With this objective, this study intended to estimate thyrotropin stimulating hormone (TSH) concentration in MetS subjects in order to estimate the prevalence of thyroid illness in them. Also, the prevalence of MetS is on the rise in the south Indian population due to rapid urbanization, thyroid dysfunction screening in this circumstance becomes essential. (4)

Studies have proved the complications arising out of overt hypo or hyperthyroidism. Hypothyroidism is the risk factor for hyperglycemia and dyslipidemia. Subclinical hypothyroidism is also been shown to be the risk factor for CHD. (5) But, the variation in TSH in the apparently healthy newly diagnosed MetS subjects is less clear. Therefore, this study intended to find the relationships between TSH and MetS components.

MATERIALS AND METHODS:

This cross sectional study was conducted in the Sri Siddhartha medical college, Tumkur. This study was carried out for a period of six months from July to December 2013 after obtaining the approval from the institutional ethics committee. The study population included the apparently healthy subjects attending the hospital for routine annual health check up. A written informed consent was obtained from the participants after explaining the objectives and procedures of the study. Fifty MetS adult (>18years) males, who fulfilled the AHA/NHLBI MetS definition for South Asians (Table 1) (6) were selected as cases and age matched 50 male subjects without MetS were considered for controls. Diagnosed diabetics, hypertensives, subjects with thyroid disorders or any other ailment were excluded from the study. Since the prevalence of thyroid dysfunction is high among the female population, this study included only male patients to minimize the variability. Blood pressure and anthropometric measurements were taken using calibrated standard instruments. The anthropometric measurements, namely body weight, height and waist circumference (WC) were measured using standardized equipments. Blood pressure was measured in a sitting position on the left arm with a mercury sphygmomanometer to the nearest 2mm Hg. Systolic (SBP) and diastolic (DBP) blood pressure measurements were taken twice to reduce intra observer variations and were averaged for the analyses. A third measurement was taken only when the difference between the two measurements was ≥ 5 mmHg. A blood samples were collected after an overnight fast of 8-12 hours. The blood samples were collected in plain, gel vacutainers, allowed to clot and centrifuged. The separated serum was used for the estimation of fasting blood sugar (FBS), lipid profile and TSH. Fasting blood sugar, lipid profile assays and TSH were estimated on an integrated Auto analyzer system (Roche Diagnostics) using dedicated calibrators, controls and reagents. Quantitative data summarized to test the difference in mean values obtained for MetS subjects and non MetS subjects using student 't' test, p value < 0.05 is taken as the level of significance. Further, Pearson's correlation was used to correlate between the TSH and the components of the MetS.

RESULTS:

The results obtained are shown in tables 2, 3 and 4. Table 2 shows the comparison of Mean ± SD between the cases and controls. It is shown that there is highly significant difference in the values not only for the MetS components but also for TSH levels. TSH levels were high among the subjects with MetS and it was statistically highly significant (<0.01).

Table 3 shows the Pearson's product-moment correlation of TSH with age and the components of the MetS. The correlation is positive and highly significant (<0.01) with age, FBS and WC. It also significantly correlated with triglyceride (TGL) (<0.05).

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Table 4 shows the reference ranges for the thyroid status employed in this study. It also shows the distribution of cases and controls as euthyroid, hypothyroid and hyperthyroid based on the TSH values. It is shown that there is significant differences in the distribution i.e. significant proportion of cases are hypothyroid and significant proportions of controls are euthyroid. It can also be inferred from the table 4 that prevalence of hypothyroidism in MetS is 46% and the hyperthyroidism is 6%, where as in controls it is 14% and 4%.

DISCUSSION:

T2DM, a sequel following the MetS is known to be associated with the thyroid disorders. (7) This study intended to identify the thyroid disorder in the at risk category for T2DM i.e. in the apparently healthy MetS subjects.

The present study shows, MetS subjects are at risk for thyroid disorder, hypothyroidism in particular. The prevalence of hypothyroidism in the MetS subjects was found to be 46%. The sensitivity and specificity of TSH for MetS was found to be 52% and 82% respectively. Uzunlulu M et al had found subclinical hypothyroidism in 16.4% of the MetS subjects. This finding made them to suggest the need for investigating the presence of subclinical hypothyroidism during the management of MetS patients. (8) This study showed much higher prevalence, population vulnerability and iodine sufficiency status may be the probable causes to be explored.

The TSH values were found to be high (4.3 ± 2.2) in the MetS when compared with the subjects without MetS (2.9 ± 1.4). The increase was statistically highly significant (<0.01). Chugh K et al in a similar study estimated the T3, T4 and TSH in subjects with and without MetS. They revealed that there was normal T3 and T4 in both the study groups but TSH levels were increased only in subjects with MetS. They attributed the raise to thyroid receptor resistance which may be a part of MetS rather than a state of hypothyroidism. (9)

TSH showed positive correlation with age and the components of the MetS. The correlation was positive and highly significant (<0.01) with age, FBS and WC. It also significantly correlated with TGL (<0.05). Kota SK et al also found that TSH levels to be correlating with the components of MetS in their cases by a linear regression model (10).

With this study it is evident that MetS patients are associated with thyroid dysfunction and the pathophysiology needs to be understood. A follow up study would be interesting if TSH levels are estimated following the intervention for MetS. The limitations of this study are small sample size, exclusion of the females and thyroid hormones were not estimated. A large sample size with full thyroid profile would validate the findings of this study.

CONCLUSION:

In conclusion, higher levels of TSH may predict the MetS and also show the relationship existing between thyroid function and metabolic syndrome components namely FBS, TGL and obesity.

Table 1: shows the AHA/ NHLBI definition of metabolic syndrome for South Asian population

Components	Males	Females
Hypertension (mm of Hg)	≥130 or 85	≥130 or 85
Hyperglycemia FBS (mg/dl)	≥100	≥100
TGL (mg/dl)	≥150	≥150
HDL (mg/dl)	<40	<50
WC (cm)	WC ≥90	WC ≥80
Any 3 of the 5 features		

Table 2: Shows the comparison of Mean ± SD between the cases and controls

	Cases	Controls	p_{value}*
Age (year)	44.4 ± 11.4	41.1 ± 17.4	0.27
Weight (kg)	73.5 ± 10.0	57.7 ± 7.9	<0.01
Height (cm)	168.5 ± 6.3	165.7 ± 7.6	0.06
Systemic blood pressure (mmHg)	129.2 ± 12.1	116.0 ± 20.2	<0.01
Diastolic blood pressure(mmHg)	87.1 ± 7.7	74.4 ± 13.4	<0.01
FBS (mg/dl)	117.1 ± 31.1	85.6 ± 8.5	<0.01
TGL (mg/dl)	211.3 ± 80.3	122.8 ± 72.7	<0.01
HDL (mg/dl)	29.5 ± 5.3	36.0 ± 7.6	<0.01
WC (cm)	95.3 ± 7.2	74.1 ± 17.2	<0.01
TSH (µIU/ ml)	4.3 ± 2.2	2.9 ± 1.4	<0.01

***student t test**

Table 3: Shows the Pearson's product-moment correlation of TSH with age and the components of the metabolic syndrome

	r value	p value
Age	0.57	<0.01
Systolic blood pressure	-0.20	0.15
Diastolic blood pressure	-0.03	0.78
FBS	0.54	<0.01
TGL	0.32	<0.05
HDL	-0.02	0.88
WC	0.52	<0.01

Table 4: Shows the reference ranges for the thyroid status and its distribution in cases and controls

Thyroid Status	TSH (µIU/ ml)	Cases	Controls	p value*
Euthyroid	0.4 – 4.2	24	41	<0.01
Hypothyroid	< 0.4	23	7	
Hyperthyroid	> 4.2	3	2	

***Fisher's Exact Test for Count Data**

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