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Original Research Article

Thyroid Dysfunction in Patients with Metabolic Syndrome and Its Relationship with Components of Metabolic Syndrome

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Abstract

Introduction: Iodine deficiency disorder (IDD) & Metabolic syndrome (Mets) has been associated with risk factors of cardiovascular disease (CVD). IDD is risk factor for CVD mediated by effects of thyroid hormone on lipid metabolism and blood pressure hence the components of Mets. It is possible that coexistence of these two disease entities and unrecognized IDD in patients with Mets might subsequently evaluate CVD risk. Moreover little is known about the relationship between IDD and the components of Mets. Thus the purpose of present study was to evaluate the pattern of IDD in patients with Mets and its relationship with components of Mets.

Methods: A total 204 diagnosed patients with Mets were recruited in the study. The thyroid function test parameter were measured to classify IDD at Chattrapati Shivaji Hospital, Subharti Medical College, Meerut, statistical analyses were performed using SSPSS version 16.0 to evaluated pattern and relationship.

Result: The overall prevalence of IDD in patients with Mets & components of Mets although there was significant difference in waist circumference of three groups of IDD. [Hypo, Hyper & subclinical thyroid disorders].

Conclusion: Present study concludes that patients with Mets had higher subclinical hypothyroidism. Although there was no evidence of any association between IDD status and all components of Mets. The IDD should be considered when evaluating & treating patients of Mets to minimize the risk.

Keywords: Iodine deficiency disorders, Metabolic syndrome, subclinical hypothyroidism.

1. Introduction

Metabolic Syndrome (MetS) has recently been perceived as a risk factor for various diseases such as cardiovascular diseases [1]. The components of MetS include dyslipidemia, hypertension, raised triglycerides, hyperglycemia and abdominal obesity [2]. Derangement of these components increases the risk of cardiovascular disease.

Thyroid hormone disorders are one of the most common forms of endocrine disorders in India. The most common cause of thyroid disorders is a primary failure of the thyroid gland.

Disorders due to hypothalamic dysfunction or pituitary or may be due to generalized tissue resistance to the circulatory thyroid hormones & TSH is also found. Thyroid disorders affect several systems of the human body. [3]

India having a population of around 1.21 billion, an estimated 108 million peoples suffer from endocrine disorders and metabolic dysfunctions [4].

Thyroid disorders associated with cardiovascular disorders, since the thyroid hormones and TSH often affect the functions of the cardiovascular system and thus Thyroid disorders considered as an independent cardiovascular risk factor. The MetS has been studied in people with various thyroid disorders. [5,6]

The MetS, a well accepted cardiovascular risk factor, is not widely studied in patients with thyroid disorder. The occurrence of the MetS in subjects with thyroid disorders may designate a state of "substantial overlap" in subjects with thyroid disorders [7].

Present study was planned to assess MetS in subjects with thyroid disorders.

2. Material & Methods

A total of 317 subjects who were willing to take part were chosen for the study, out of which 204 patients were randomly selected. Data of 92 male and 112 female, from the age group of 20 to 60 years were selected from January 2015 to December 2016 in a cross sectional manner. Information about subject's age, sex, family history of endocrine disease and other chronic diseases/disorders were recorded in a predesigned format. Height, weight and waist circumferences were measured with the subject barefooted and lightly dressed.

The abdominal circumference (waist) was measured at the end of expiration, by wrapping the non elastic tape at the level of the umbilicus. Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters.

2.1 Inclusion criteria

The patients who were between the age group 20 to 60 years, all patients who were diagnosed with goiter with or without an abnormal thyroid function test and also those with an abnormal thyroid function test in the absence of goiter are included and also patients with a complete clinical history (particularly of thyroid hormones abnormality disease) and laboratory data (total serum cholesterol, Triglycerides, HDL-C, LDL-C, FBS).

2.2 Exclusion criteria

The Patients with malignancy or drug induced thyroid disorders and all patients with renal disorders, liver disorders coronary artery diseases, female patients who are on oral contraceptive pills and pregnant women's.

2.3 Sample collection

Blood sample (5ml) after overnight fasting collected from each subject. Serum separated by centrifuging blood at 3000 rpm for 10 min, Fasting blood sugar and lipid profile were assayed on Vitros 250 auto analyzer Johnson and Johnson USA by using Biored quality control.

We choose the IDF criteria for MetS [8] over NCEP:ATP III (National Cholesterol Education Program Adult Treatment Panel III) since the IDF criteria take the account of ethnicity whereas ATP III is applied to American Population only. The circulating thyroid hormones assayed for T3, T4 and TSH by enzyme linked florescent assay (ELFA) technique using Vidas auto-analyzer. The reference range for T3, T4 and TSH for our laboratory as:

T3: 1.23–3.23 nmol/L,
T4: 59–135 nmol/L &
TSH: 0.4–4.2 mIU/L respectively.

The patients were categorized into three groups. Those having T3, T4, and TSH levels within the reference range were categorized into the euthyroid group; patients having low T3, T4 and high TSH were in the hypothyroid group; and those having high level of T3 and T4 and lower TSH levels with respect to the reference range were regarded as hyperthyroid group.

2.4 Statistical Analysis

Statistical analysis was carried out with SPSS 16. ANOVA software package used in evaluation of significance between the mean of the two groups. Data were presented as mean ± SD (standard deviation). Intergroup differences were tested by independent sample test (two groups).

P-value < 0.0001 was taken as statistical significant.

3. Result

Out of total 317 subjects, we randomly selected 204 subjects in which 132 are cases and 72 are controls, cases are screened for presence of MetS out of which Male is 25% & Female is 31.8%, the F: M ratio is 1:0.78 and 56.8 % of the cases shows symptoms MetS (Table 1)

Table 1: Difference in components of Mets among thyroid dysfunction subgroups

Thyroid disorders	Age groups (in years)				Total
	20-30	31-40	41-50	51-60	
Hypothyroid	4(3%)	12(9%)	27(20.4%)	9(6.8%)	52(39.3%)
Hyperthyroid	1(0.7%)	3(2.2%)	13(9.8%)	6(4.5%)	23(17.4%)
Total	5(3.7%)	15(11.3%)	40(30.3%)	15(11.3%)	75(56.8%)

Table 2: Distribution of study subjects in cases & control groups according to the presence of different variables contributing to metabolic syndrome

Parameters	Cases N=132	Control N=72	P Value	95%CI	t value
Age (in years)	43.34±8.04	41.90±9.47	<0.0001	0.82-0.95	27.97
BMI (kg/m^2)	31.36±7.55	29.19±8.05	<0.0001	0.72-0.87	21.22
W.C (in inch)	103.20±9.55	90.47±8.64	<0.0001	0.82-0.88	58.91
FBG (mg/dl)	141.95±39.04	100.37±12.31	<0.0001	0.62-0.72	25.94
T.C (mg/dl)	204.8±32.50	199.95±58.87	<0.0001	0.89-0.98	43.68
TG (mg/dl)	210.25±48.44	188.19±38.92	<0.0001	0.79-0.91	28.58
LDL-C (mg/dl)	129.55±30.39	132.33±25.39	<0.0001	0.88-1.01	31.44
VLDL-C (mg/dl)	41.62±9.70	37.76±8.45	<0.0001	0.76-0.89	27.48
HDL-C (mg/dl)	32.73±5.36	33.45±4.97	<0.0001	0.91-1.03	34.05

Table 2 showed the age of the total study subjects ranged from 20 to 60 years. In control group mean age of subjects was 41.90±9.47 years whereas in case group mean age of subjects was 43.34±8.04 years respectively. Mean of BMI, W.C, FBS, TC and TG were higher in cases as compared to HDL which is higher in control group as compared to case group. The present study was a case-control study, to exclude any gender bias or age, an attempt was made to include controls of similar age and gender as of controls.

Table 3: Correlation between components of Mets with levels of T_3, T_4 & TSH among patients with Mets

Parameters	T3		T4		TSH	
	r	P	r	P	r	P
W.C (in inch)	0.21	0.01	0.170	0.04	-0.180	0.03
FBS (mg/dl)	0.002	0.97	0.020	0.80	-0.055	0.53
TG(mg/dl)	-0.006	0.94	-0.038	0.66	-0.016	0.85
HDL-C(mg/dl)	-0.016	0.84	-0.019	0.82	0.108	0.21
LDL-C(mg/dl)	-0.068	0.43	0.003	0.96	0.049	0.57
Systolic BP (mm of hg)	-0.045	0.60	-0.058	0.50	-0.024	0.77
Diastolic BP (mm of hg)	0.015	0.85	0.027	0.75	-0.175	0.04

Correlation is significant at the 0.05 level.

Table 3 showed that serum T3 correlates positively with waist circumference and fasting sugar level, T4 correlates positively and significantly with waist circumference, while correlates only positively with fasting sugar level and LDL cholesterol, whereas TSH correlates positively only with LDL and HDL Levels.

4. Discussion

Indian population is on a high risk with respect to cardiovascular and diabetes mellitus, and their numbers are consistently rising [9]. Metabolic syndrome is considered as a cluster of cardiometabolic risk factors like obesity, hypertension, hyperglycemia and hypertriglyceridemia, increased BMI, WC and low HDL [10]. Various studies have been carried out in India on metabolic syndrome, however very limited data is available on correlation of thyroid hormones with different components of metabolic syndrome in Indian population.

In the present study, we have found a significant relationship between levels of thyroid hormones and metabolic risk factors as reported in various previous studies [11, 12]. Our results also indicate that the deranged thyroid hormones levels may predict the MetS on the study subjects. These findings might be implicated that subjects with abnormal thyroid gland function are already at increased risk of metabolic syndrome leading to cardiovascular diseases.

In a study conducted by Bakker *et al*. [13] found that TSH seemed to affect these important cardiovascular risk factor.

In a cross- sectional study researchers also reported a close relationship between TSH and MetS in euthyroid subject [14]. Thyroid hormones and TSH play an important role in a variety of developmental and metabolic processes in the human body. The pathophysiological process behind the influence of thyroid function on lipid metabolism is known from subjects with thyroid disorders. The elevation of TGs is caused by a reduced removal rate of TG from plasma due to a decrease in the activity of hepatic TG lipase [15,16] our results also showed the associations of thyroid hormones to cardiovascular diseases risk factors. Similarly several important cardiovascular risk factors have been identified in patients with thyroid disorders [17]

In a study conducted by Sangeeta N *et al* [18] found that the parameters of lipid profile i.e., TC, LDL and TG were found to be deranged in thyroid disorders and levels of HDL were found to be decreased with respect to

the reference range and Positive correlation was observed between, TSH and LDL, we have also found the similar results i.e. the deranged lipid profile of cases which are of thyroid patients and also there is a positive correlation between TSH and LDL.

In various studies[19] authors have found that thyroid hormones affect LDL through different mechanisms like LDL catabolism aside from metabolic alterations, stimulation of total cholesterol and effects on biliary lipid metabolism. In a investigation conducted by Punia *et al*.,[20] concluded that patients having thyroid disorders have high TG value and low HDL values, which is in accordance to our study in which we state that high TG values and low HDL values in cases as compared to controls

5. Conclusion

In view of our study we concluded that there is a possible association between thyroid hormones, TSH and metabolic syndrome and it highlights the importance of diagnosis of metabolic syndrome in patients of thyroid disorders.

It is still not clear whether alterations in thyroid hormones TSH cause an effect on Mets suggesting that there is a need for further evaluation on a large scale taken consideration of multifactorial and interdependent pharmacokinetics and dynamics of various hormones

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