Original Research Article

A comparative study of subclinical hypothyroidism in metabolic syndrome with patient not having metabolic syndrome

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Abstract

Aim: To evaluate the thyroid status in metabolic syndrome in comparison to healthy controls. To correlate the components of MetS with thyroid status.**Material and methods:** This was a cross-sectional study was done in the Department of General Medicine, Narayan Medical College and Hospital, Sasaram, Bihar, India, for 1 year. A total sample size of 100 (50 cases of metabolic syndrome matched with 50 controls) were included in the study. T3, T4 and TSH was analysed by chemiluminiscence assay in Access-2 hormone analyser. The biochemical assays were routinely monitored through internal and external quality programs. **Results:** The study population comprised of 56% male and 44% female among controls whereas cases had a slight female predominance with 58% being female and 42% being male. The mean age of the study population was 51.21±11.21 among cases and 48.36 ± 9.87 among controls. Difference of each of the component of Met S between the patients of Met S and control was tested using Student t-test. Significant difference with p value < .00001 was observed in each of the component of Met S between cases and controls. TSH showed significant difference (p= 0.02) with the mean TSH in cases group as 8.42 ± 3.12 and in control as 3.11 ± 0.42 whereas T3 and T4 showed no significant difference between both the groups shown in Table 2. Subclinical hypothyroidism (SCH) is the predominant pattern of thyroid dysfunction observed in 24 % of patients having Met S, followed by overt hypothyroidism in 6% as shown in while there where were no cases of overt hyperthyroidism. The correlation of TSH with the components of Met S was assessed using Pearson correlation coefficient. Waist circumference positively correlated with high TSH and was statistically significant (p = 0.02). **Conclusion:** The prevalence of TD in patients with Metabolic syndrome was high, indicating a possible interplay between thyroid status and MetS. Hypothyroidism was the most common TD in Indian patients with MetS.

Keywords: Metabolic syndrome, Thyroid stimulating hormone, Hypothyroidism, Central obesity.

Introduction

Serum TSH has been associated with components of the metabolic syndrome. In studies comparing euthyroid subjects with subclinical hypothyroid subjects, people in the subclinical hypothyroid group have a higher prevalence of high blood pressure and Dyslipidemia [1,2]. Also in the euthyroid range, serum TSH is positively associated with blood pressure, total cholesterol (TC), triglycerides, and LDL, and negatively associated with HDL[3,4]. In a population-based study that examined the association of different components of the metabolic syndrome between subjects with euthyroid and hypo- or hyperthyroidism,a higher prevalence of hypertension,higher triglycerides,and lower HDL in subjects with subclinical hypothyroidism was observed. In addition, obesity was significantly correlated with serum TSH[5]. In two cross-sectional studies performed in euthyroid people, serum TSH was associated with higher triglycerides and an increased risk of the metabolic syndrome[6,7].Another study with a follow-up period of 3 years found that serum TSH was associated with increased triglycerides, TC, waist circumference, and blood pressure, and decreased HDL, TC, waist circumference, and blood pressure and that subjects with metabolic syndrome had an increased serum TSH over time[8]. In general, these studies have been performed in younger populations. The association between serum TSH and the metabolic syndrome may differ when examined in an older population and also may have other implications. With the increasing number of elderly people, it is important to examine the association between serum TSH and metabolic syndrome specifically in the elderly. In Taiwanese older persons, a higher prevalence of the metabolic syndrome in persons

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with subclinical hypothyroidism when compared with persons with subclinical hyperthyroidism was found[9].In the same population, TSH was positively associated with triglycerides and blood pressure and an increased prevalence of metabolic syndrome[10]. Recently, Waring et al. found that higher serum TSH was associated with an increase in the odds of prevalent metabolic syndrome and this association was even stronger for TSH within the normal range. Furthermore, subclinical hypothyroidism with a TSH< 10 mU/l was significantly associated with increased odds of prevalent metabolic syndrome[11]. The aim of the present study was to evaluate the thyroid status in MetS in comparison to healthy controls. To correlate the components of MetS with thyroid status.

Material and methods

This was a cross-sectional study was done in the Department of, Department of General Medicine, Narayan Medical College and Hospital, Sasaram, Bihar, India for 1 year. after taking the approval of the protocol review committee and institutional ethics committee.

Methodology

Patients with diabetes related complications, those having liver and renal dysfunction, on corticosteroids or other medication that alters lipid, glucose or thyroid parameters, and pregnant women, those with history of cardiovascular disease were excluded from the study. After obtaining consent, the waist circumference and BP measurements were taken. Study group were requested to give sample after overnight fasting. Under aseptic conditions, 5ml blood was drawn in plain vacutainers and was assayed after centrifugation. Fasting blood glucose and lipid profile was estimated by enzymatic assay in fully automated clinical chemistry analyser (Beckman Coulter AU480).

Subjects who as per NCEP ATP III criteria had the presence of any 3 of the 5 following components namely

1. Waist circumference more than 40 inches (102 cm) in male and 35 inches (88 cm) in female
2. Fasting blood glucose more than 100 mg/dl or on treatment
3. Triglycerides more than 150 mg/dl or on treatment
4. HDL cholesterol less than 40 mg/dl in males and less than 50 mg/dl in females.
5. Systolic more than 130 mmHg and diastolic more than 85 mmHg or on treatment were grouped as cases and subjects who were healthy and normal were grouped as controls.

A total sample size of 100 (50 cases of MetS matched with 50 controls) were included in the study. T3, T4 and TSH was analysed by chemiluminiscence assay in Access-2 hormone analyser. The biochemical assays were routinely monitored through internal and external quality programs. Subjects were classified into one of the following 5 groups: euthyroid, hypothyroid, hyperthyroid, subclinical hypothyroid or subclinical hyperthyroid based on guidelines of diagnosing thyroid dysfunction.[12]The factors of Met S were expressed as mean + SD and significance was tested by Student t test. Pearson correlation coefficient was used to correlate the components of Met S and thyroid function test.

Results

The study population comprised of 56% male and 44% female among controls whereas cases had a slight female predominance with 58% being female and 42% being male. The mean age of the study population was 51.21 ± 11.21 among cases and 48.36 ± 9.87 among controls. The mean fasting blood glucose, waist circumference, triglyceride levels, high density lipoprotein, systolic and diastolic blood pressure which are the components of Met S in cases and controls are shown in table 1. Difference of each of the component of Met S between the patients of Met S and control was tested using Student t-test. Significant difference with p value < .00001 was observed in each of the component of Met S between cases and controls as shown in Table 1. Thyroid profile comprising of T3, T4 and TSH was assessed in the study group. TSH showed significant difference (p= 0.02) with the mean TSH in cases group as 8.42 ± 3.12 and in control as 3.11 ± 0.42 whereas T3 and T4 showed no significant difference between both the groups shown in Table 2. Subclinical hypothyroidism (SCH) is the predominant pattern of thyroid dysfunction observed in 24 % of patients having Met S, followed by overt hypothyroidism in 6% as shown in while there where were no cases of overt hyperthyroidism as in table 3. The correlation of TSH with the components of Met S was assessed using Pearson correlation coefficient. Waist circumference positively correlated with high TSH and was statistically significant (p = 0.02). Fasting blood glucose, HDL and blood pressure negatively correlated while triglyceride showed positive correlation with high TSH but none of them were statistically significant as given in Table 3.

Table 1: Comparison of components of MetS among cases and controls

Parameters	Cases (Mean ± SD)	Controls (Mean ± SD)	'p' Value
Fasting blood glucose (mg/dl)	218 ± 81.31	89.85 ± 9.84	<.00001****
Waist circumference (inches)	40.15 ± 2.45	32.4 ± 2.32	<.00001****
Triglycerides(mg/dl)	205.26± 73.6	112.4 ± 31.23	<.00001****
HDL(mg/dl)	33.12 ±7.1	41.2± 6.1	<.00001****
Systolic blood pressure(mmHg)	141.7 ± 9.22	122.7 ± 8.23	<.00001****
Diastolic blood pressure(mmHg)	94.98 ± 5.7	80± 4.2	<.00001****

Table 2: Comparison of thyroid profile among cases and controls

Parameters	Cases (Mean ± SD)	Controls (Mean ± SD)	'p' Value
T 3 (ng/ml)	0.86 ± 0.19	0.91 ± 0.24	0.1
T 4 (µg/dL)	9.12 ±2.7	9.4 ±2.6	0.2
TSH (µIU/ml)	8.42 ± 3.12	3.11 ± 0.42	.0347

Table 3: Pattern of Thyroid dysfunction in patients with metabolic syndrome

Pattern of Thyroid dysfunction	Percentage
Euthyroid	70
Subclinical hypothyroidism (SCH)	24
Overt hypothyroidism	6

Table 4: Correlation of TSH with component of Met S

Parameter 1	Parameter 2	'r' Value	P value
TSH	Fasting blood glucose	- 0.16	0.45
TSH	Waist circumference	0.34	0.02*

TSH	Triglycerides	0.04	0.9
TSH	HDL	-0.18	0.37
TSH	Systolic blood pressure	-0.111	0.53
TSH	Diastolic blood pressure	-0.161	1.31

Discussion

Our study showed significant difference in the mean values of the baseline characteristics of Met S between the cases and controls. Similar findings were obtained in study by Meher et al[13]and Gywali et al[14] where all the biochemical and anthropometric measurement relating to the components of Met S was significantly higher in the cases than in the control group except for HDL which was lower in the cases group. Obesity alters glucose metabolism by causing insulin resistance which in turn causes decrease glucose uptake by the muscle and increase glucose output by the liver leading to hyperglycemia[15]. Insulin resistance contributes to the development of hypertension either directly by increasing catecholamine activity or indirectly by increasing renal tubular sodium reabsorption[16]. High triglycerides and low HDL elevates the LDL cholesterol which is the most atherogeniclipo protein.[17] Thus there is a strong interlink between the components of MetS. Our study showed that the female subjects with MetS had a increased prevalence of TD than those among male subjects, which is in accordance with previous studies carried out by Gywali et al[14],Katiwada et al , Shantha et al[18-21]Thyroid function test revealed TSH significantly higher in the MetS group. There was no significant difference in levels of T3 and T4 in both groups. Chugh et al concluded on similar findings in his study of thyroid function test in metabolic syndrome patients wherein only TSH showed significant difference between the two groups[22].In contrast study by Gyawali et al showed both TSH and fT4 significantly altered[14].TSH being significantly high and T3, T4 being normal in patients with MetS may imply that Met S is associated with an increased risk of SCH. It is well documented that increased TSH has been linked to weigh gain and obesity. Increased TSH levels may be attributed to leptin which is an adipocyte derived hormone which is increased in obesity. It is postulated that leptin regulates the Thyrotropin releasing hormone synthesis by its effect on the hypothalamic pituitary axis leading to the subsequent increase of TSH production[23,24].Our study showed Thyroid dysfunction in 30% of Met S patients with a high prevalence of subclinical hypothyroidism (SCH) (24%) followed by overt hypothyroidism (6%). We did not however find any cases of hyperthyroidism. Study carried out in Nepal by Gyawali et al[14] reported similar prevalence of thyroid dysfunction (31.8%) in Met S with predominant patients having SCH (29.32%) followed by overt hypothyroidism (1.67%) and subclinical hyperthyroidism (0.83%). Most studies on the pattern of thyroid dysfunction in Met S patients have reported the high prevelance of SCH[18,19]. SCH down regulates GLUT (glucose transporters) and hence decrease the intracellular glucose uptake and also increases gluconeogenesis thus leading to hyperglycemia[16]. While it is well known that overt hypothyroidism is a hypometabolic state leading to obesity, recent evidences show SCH also being associated with significant weight gain. Thus, the pathophysiology of Met S and SCH seem to have a considerable overlap[25,26]. Relationship between the components of Met S and thyroid dysfunction have been largely varied and still not conclusive based on previous studies[15,18,19,27].The diverse ethnicity, lifestyle, race, age, gender of the study population maybe be liable for the discrepancy. We, however found no statistically significant correlation between the components of Met S and thyroid hormones, except for waist circumference. In contrast, other studies have shown association of thyroid function to lipid profile and high insulin resistance in turn leading to hyperglycemia [19,28]. This could be attributed to the smaller sample size in our study. Thus, epidemiological studies on a large study population are required to clearly establish the association between the TD and the components of Met S. The other limitation being that this being a cross sectional studies the cause and effect of the study could not be investigated. Also fT3 and fT4 could have been more accurate to reflect thyroid status.

Conclusion

Thyroid dysfunction, predominantly sub clinical hypothyroidism was more frequent in MetS patients. It is thus imperative to screen MetS patients for thyroid dysfunction in order to prevent cardiovascular related mortality

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