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Study of thyroid profile among metabolic syndrome patients: A Prospective Study

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ABSTRACT

Background: Metabolic syndrome (MetS) is a combination of risk factors such as hypertension, atherogenic dyslipidemia, hyperglycemia, truncal (central) obesity, and prothrombotic and proinflammatory conditions, which could increase the risk of cardiovascular illness, diabetes, and death. Thyroid diseases are, arguably, among the commonest endocrine disorders worldwide. India too, is no exception. According to a projection from various studies on thyroid disease, it has been estimated that about 42 million people in India suffer from thyroid diseases.

Materials and methods: This is a prospective and cross sectional study including 210 patients of metabolic syndrome. A detailed history, clinical examination and relevant investigations including serum Free T4 (FT4), Free T3 (FT3), Thyroid Stimulating Hormone (TSH) were done. Range, frequencies, percentage, mean, standard deviation and P value were calculated. Both gender patients aged 18 to 65 years with features of metabolic syndrome according to International Diabetes Federation criteria 2020 were included in the study.

Result: In our study, Patient with MetS group consisted of 61.42 % (n = 129) males and 38.57 % (n = 81) females. in Patient with MetS group FBG (mg/dL) was 132.07±14.39, TG (mg/dL) 235.75±24.29, HDL-C (mg/dL) 39.32±4.23, TSH (µIU/mL) 6.11±0.53. Pattern of thyroid dysfunction such as subclinical hypothyroidism (40.4 %) was the commonest followed by overt hypothyroidism (4.28 %) and subclinical hyperthyroidism (2.85 %).

Conclusion: Thyroid dysfunction, particularly subclinical hypothyroidism is common among metabolic syndrome patients, and is associated with some components of metabolic syndrome (waist circumference and HDL cholesterol).

Keywords: Metabolic syndrome, Subclinical hypothyroidism, Thyroid dysfunction

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INTRODUCTION

Metabolic syndrome (MetS) is a combination of risk factors such as hypertension, atherogenic dyslipidemia, hyperglycemia, truncal (central) obesity, and prothrombotic and proinflammatory conditions, which could increase the risk of cardiovascular illness, diabetes, and death. According to an estimate by the International Diabetes Foundation, nearly one-fourth of the world's population has MetS. [1] The prevalence rates vary greatly depending upon the definition of MetS, ethnicity, age, population, etc. Recently, a rapid increase in its prevalence has been noted in India due to socioeconomic transitions to increasing affluence, urbanization, mechanization, and urban migration. [2] About one third of the urban population in large Indian cities has MetS with the overall prevalence varying between 11% and 56%. [3]

Thyroid diseases are, arguably, among the commonest endocrine disorders worldwide. India too, is no exception. According to a projection from various studies on thyroid disease, it has been estimated that about 42 million people in India suffer from thyroid diseases. [4] Thyroid diseases are different from other diseases in terms of their ease of diagnosis, accessibility of medical treatment, and the relative visibility that even a small swelling of the thyroid offers to the treating physician. Early diagnosis and treatment remain the cornerstone of management. There are five types thyroid diseases (hypothyroidism, hyperthyroidism, goiter/iodine deficiency disorders, Hashimoto's thyroiditis, and thyroid cancer). [5]

MetS is closely associated with thyroid dysfunction (TD) due to the impact of thyroid hormones on lipid metabolism, glucose, blood pressure, and cardiovascular dysfunction. [6] Functional changes in the thyroid gland might have an association with MetS and its related components including obesity, insulin resistance (IR), lipid and glucose metabolism abnormalities, raised blood pressure, and cardiovascular dysfunction. MetS and TD are both characterized by a cluster of common abnormalities such as abdominal obesity, hyperglycemia, hypertension, reduced high-density lipoprotein cholesterol (HDL-C), and elevated triglycerides (TG). Moreover, IR, identified as a basic mechanism for MetS, also plays a role in hypothyroidism. [7] The occurrence of both the conditions may be compounded to increase the risk for cardiovascular diseases (CVDs).

MATERIALS AND METHODS

This prospective and cross sectional study was conducted at the outpatient and inpatient of General Medicine department and Department of Biochemistry, Dr VRK Womens Medical College, Teaching hospital and Research center over a period of 1 year. The study was pre-approved by the Institutional Ethics Committee (IEC) for the final permission. After obtaining the permission of IEC the study was conducted.

Inclusion Criteria:

Both gender patients aged 18 to 65 years with features of metabolic syndrome according to International Diabetes Federation criteria 2020 were included in the study.

Exclusion Criteria:

Patients with primary thyroid disorder, irradiation of thyroid gland, thyroidectomy or thyroid surgeries, on drugs like anti-thyroid drugs, drugs that alter thyroid functions, lipids such as

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statins, lithium, amiodarone, oral contraceptive pills, steroid; with liver disorders; with renal disorders, in congestive cardiac failure, pregnant women and those who are taking iodized salt were excluded from the study.

Proper informed consent was taken before including the patients. A detailed history and clinical examination were done. Investigations including complete blood count, liver function test, renal function test, fasting blood sugar, fasting lipid profile, ultrasonography scan of abdomen, ultrasonography scan neck, serum FT4, FT3, TSH were done. Metabolic syndrome patients were considered to have thyroid dysfunction if patients thyroid hormones level fell outside the reference range free T3 (0.31–0.65 ng/dl), free T4 (0.7–1.6 ng/dl) and TSH level (0.25–5 mIU/L)). Patients were said to be euthyroid if all thyroid hormone levels fell within reference range. Overt hypothyroidism was defined as TSH > 5 mIU/L, free T3 < 0.31 ng/dl and free T4 < 0.7 ng/dl. Subclinical hypothyroidism was considered if TSH > 5 mIU/L and free T3 and free T4 within reference range. Subclinical hyperthyroidism was defined as TSH < 0.25 mIU/L and free T3 and free T4 within reference range.

Statistical Analysis

Frequency analysis, percentage analysis and Chi- square test. P value of < 0.05 was taken as significant. Microsoft Excel 2013 and SPSS (Statistical Package for Social Sciences) Version 22.0 software was used for data entry and analysis.

RESULTS

Table 1. Distribution of Gender of metabolic syndrome patient and healthy control subjects

Gender	Patient with MetS group (n=210) (Percentage)	Healthy control group (n=190)
Male	129 (61.42%)	**113 (59.47%)**
Female	81 (38.57%)	77 (40.52%)
Total	210 (100%)	100 (100%)

In our study, Patient with MetS group consisted of 61.42 % (n = 129) males and 38.57 % (n = 81) females in table 1.

Table 2. Anthropometric parameters for patient with metabolic syndrome and healthy control subjects

Parameter	Patient with MetS group (n=210)	Healthy control group (n=190)	P value
SBP, mmHg	138.97 ±14.74	126.55±13.97	0.000
DBP, mmHg	91.34±10.18	82.09±9.25	0.000
WC, cm	85.39±9.19	79.09±8.95	0.000

MetS, metabolic syndrome; SBP, systolic blood pressure; DBP, diastolic blood pressure; WC, waist circumference.

Values are presented as group range or Mean±standard deviation. P<0.05 from the student t-test of the measured variables between MetS and control group.

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Table 3. Biochemical parameters for patient with metabolic syndrome and healthy control subjects

Parameter	Patient with MetS group (n=210)	Healthy control group (n=190)	P value
FBG, mg/dL	132.07±14.39	101.68±11.37	0.000
TG, mg/dL	235.75±24.29	150.85±16.95	0.000
HDL-C, mg/dL	39.32±4.23	44.25±4.89	0.000
fT3, pg/mL	2.21±0.96	2.16±0.71	0.139
fT4, ng/mL	2.23±0.15	1.03±0.12	0.000
TSH, µIU/mL	6.11±0.53	2.15±0.13	0.000

In table 3, in Patient with MetS group FBG (mg/dL) was 132.07±14.39, TG (mg/dL) 235.75±24.29, HDL-C (mg/dL) 39.32±4.23, TSH (µIU/mL) 6.11±0.53.

Table 4. Difference in components of metabolic syndrome among thyroid dysfunction subgroups

Pattern of thyroid dysfunction	Frequency (n=110)	Percentage
Euthyroid	110	52.38
Subclinical hypothyroidism	85	40.47
Hypothyroidism	9	4.28
Subclinical hyperthyroidism	6	2.85
Total	210	100

In table 4, Pattern of thyroid dysfunction such as subclinical hypothyroidism (40.4 %) was the commonest followed by overt hypothyroidism (4.28 %) and subclinical hyperthyroidism (2.85 %).

Table 5. Correlation between components of MetS with levels of fT4 and TSH among patients with MetS (linear regression model)

Component	fT4		TSH	
	β	Sig[a]	β	Sig[a]
SBP, mm Hg	0.099	0.239	-0.001	0.990
DBP, mm Hg	0.041	0.669	-0.065	0.463
WC, cm	0.261	0.004	-0.128	0.141
FBG, mg/dL	0.083	0.351	0.085	0.325
TG, mg/dL	-0.059	0.551	-0.110	0.213
HDL-C, mg/dL	0.033	0.755	0.075	0.399

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MetS, metabolic syndrome; fT4, free thyroxine; TSH, thyroid stimulating hormone; SBP, systolic blood pressure; DBP, diastolic blood pressure; WC, waist circumference; FBG, fasting blood glucose; TG, triglyceride; HDL-C, high density lipoprotein cholesterol. aCorrelation is significant at the 0.05 level.

Table 6. Difference in components of metabolic syndrome among thyroid dysfunction subgroups

Parameter	Euthyroid (n=110)	Subclinical hypothyroidism (n=85)	Hypothyroidism (n=9)	Subclinical hyperthyroidism (n=6)	P value
SBP, mm Hg	138.80±18.993	137.88±21.09	137.00±10.371	165.34±17.279	0.079
DBP, mm Hg	91.95±12.598	90.03±12.05	92.00±8.331	95.30±7.779	0.673
WC, cm	87.73±13.399	85.68±11.655	69.69±8.059	80.40±12.513	0.001
FBG, mg/dL	133.93±52.971	132.23±43.268	122.41±14.771	119.13±33.025	0.923
TG, mg/dL	238.48±139.229	242.11±132.461	155.61±79.450	215.13±58.891	0.431
HDL-C, mg/dL	39.30±6.471	39.13±6.015	41.51±6.043	37.43±4.085	0.432

Values are presented as Mean±standard deviation. F value and P value derived from one-way analysis of variance that used to evaluate in the four groups. SBP, systolic blood pressure; DBP, diastolic blood pressure; WC, waist circumference; FBG, fasting blood glucose; TG, triglyceride; HDL-C, high density lipoprotein cholesterol.

DISCUSSION

Metabolic syndrome can be associated with endocrine and non-endocrine disorders and has widespread consequences. Alterations in thyroid functions, though well known, are not recognized clinically and there is inconsistency in thyroid functions in metabolic syndrome. [8] The present study identifies thyroid dysfunction as a common endocrine disorder in metabolic syndrome patients; subclinical hypothyroidism (40.4 %) was the commonest followed by overt hypothyroidism (4.28 %) and subclinical hyperthyroidism (2.85 %).

Our findings are consistent with previous studies investigating thyroid function in metabolic syndrome patients. A study by Gyawali et al. reported thyroid dysfunction in 31.84 % of metabolic syndrome patients, the most common dysfunction was subclinical hypothyroidism (29.32 %) followed by overt hypothyroidism (1.67 %) and subclinical hyperthyroidism (0.83 %). [9] Previous studies, thyroid function status of adult population from cross-sectional studies in community settings are unavailable, hospital based studies by Baral et al. have reported higher rate of thyroid disorders. [10] Study by Liu YY et al. reported hyperthyroid and hypothyroid in 13.68 % and 17.19 % of the general population respectively. [11] Prevalence of higher rates of thyroid dysfunction in our region may be due to higher rate of thyroid autoimmunity, iodine deficiency or iodine excess. Recent findings about iodine nutrition among children of our region indicate excess iodine intake in these areas as revealed by excess urinary iodine excretion.

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In our study, Patient with MetS group consisted of 61.42 % (n = 129) males and 38.57 % (n = 81) females, and this has been observed in a number of studies including the general population. [12] The TSH level of metabolic syndrome patients in our study was in upper normal range, which suggests some degree of thyroid dysfunction in such patients. In a case control study assessing CVD risk factors in an eastern Indian population, the mean TSH level of a healthy control population was 2.05±1.07 mIU/L, which is lower than the mean TSH of this present study. [13] The TSH level was above the reference range for normal population in the study of Gyawali et al., observed significantly higher TSH level in metabolic syndrome patients as compared to controls. [9] A positive association has also been reported, between a higher TSH level within the euthyroid reference range and the prevalence of the metabolic syndrome. [14] A study in North India indicated that higher levels of TSH may predict the metabolic syndrome in the study subjects, suggesting that the influence of thyroid function on metabolic abnormality extends into subjects without metabolic syndrome. [15]

Our current findings may be due to small number of thyroid dysfunction patients (overt hypothyroidism and subclinical hyperthyroidism). Hypothyroidism is associated with factors of metabolic syndrome such as dyslipidemia, hypertension, obesity, and often insulin resistance. It has been reported that 95 % of newly diagnosed hypothyroid patients have increased levels of cholesterol and 5 % of have hypertriglyceridemia. Hypothyroidism also leads to increased level of LDL cholesterol. All these factors directly contribute to accelerated atherosclerosis. [16]

The correlation between subclinical hypothyroidism and metabolic syndrome and its components varies in different studies and seems to be influenced by age, gender and race of study participants. [17] Thyroid hormones affect lipid metabolism and thus the components of metabolic syndrome.

Our findings are similar to previous study, where no significant relationship between components of metabolic syndrome and thyroid dysfunction were found except for waist circumference. There are contrasting reports about the association between various metabolic syndrome parameters and thyroid function. In a study in India, subclinical hypothyroidism was significantly associated with metabolic syndrome and a linear association was observed between TSH levels and total cholesterol, triglycerides, LDL, and HDL cholesterol levels across the metabolic syndrome group. However, in a study in Turkey, TSH was not related with any metabolic syndrome parameters. [18]

High prevalence of overt and subclinical hypothyroidism in metabolic syndrome as seen in our study may have harmful effect on cardiovascular health. Hypothyroidism will lead to increased lipid levels and hypertension leading to increased risk for CVD. The effects due to metabolic syndrome and hypothyroidism may be compounded to increase risk for CVD. [19] Thus, assessing thyroid function in metabolic syndrome patients may help identify patients at high risk for CVD. However, it is still unclear whether patients with subclinical hypothyroidism should be treated, and the distinct benefit of prescribing levothyroxine for cardiovascular benefits in these patients is still debatable. [20]

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The present study has however several limitations. First the sample size was small, which may have affected the correlation between components of metabolic syndrome and thyroid function. Second, the iodine nutrition status in the patients was not assessed. It has been found that both iodine deficiency and excess can lead to thyroid disorder particularly subclinical hypothyroidism. Also, the presence of thyroid autoimmunity in the study population may lead to higher rate of thyroid dysfunction.

CONCLUSION

In conclusion, the study finds thyroid dysfunction specifically subclinical hypothyroidism is a common endocrine disorder in Indian patients with metabolic syndrome, and thyroid function is associated with certain components of metabolic syndrome (waist circumference and HDL cholesterol).

Abbreviations BMI:

Body mass index; BP: Blood pressure; CVD: Cardiovascular disease; Free T3: Free triiodothyronine; Free T4: Free thyroxine; HDL: High density lipoprotein; LDL: Low density lipoprotein; TSH: Thyroid stimulating hormone.

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