Original Article

Assessment of Thyroid Dysfunction Among Patients with Metabolic Syndrome in A Tertiary Care Hospital

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Abstract

Background: The metabolic syndrome is a set of interdependent metabolic diseases, including central obesity, hypertension, dyslipidemia, and insulin resistance, which significantly increases the possibility of cardiovascular disease and type 2 diabetes mellitus. Thyroid illness, particularly hypothyroidism, has been reported to influence various dimensions of Metabolic syndrome, including lipid metabolism, body weight, and insulin sensitivity. The early diagnosis of thyroid abnormalities in Metabolic syndrome sufferers can result in enhanced treatment and prevent the emergence of adverse effects in the long run. The objective of this study was to assess the prevalence and trend of thyroid dysfunction among patients diagnosed with metabolic syndrome. **Material and Methods:** The study was an observational study conducted over 8 months in a General Medicine Outpatient Department. A total of 65 patients who met the International Diabetes Federation (IDF) criteria for metabolic syndrome were included. A thorough clinical evaluation was performed, including anthropometric measurements, blood pressure, and a comorbidity history. The laboratory tests involved FBG testing, lipid profile, and thyroid testing (serum TSH, free T3, and free T4). The purpose of the data analysis was to determine the level of thyroid dysfunction, the type of thyroid abnormality, and its association with elements of the metabolic syndrome. **Results:** Of the 65 patients suffering metabolic syndrome, 29 (44.6) were found to have thyroid dysfunction. Subclinical hypothyroidism, which was present in 18 patients (27.7%), followed by overt hypothyroidism in 7 patients (10.8%), was the predominant anomaly. Hyperthyroidism was less frequent (only 4 patients, 6.1%). The prevalence of thyroid dysfunction was higher among female patients and older individuals (age 40+). Patients with thyroid dysfunction had a strong association with increased waist circumference, elevated triglycerides, and elevated fasting blood glucose (relative to patients with normal thyroid function). They did not find any significant correlation between thyroid functioning and blood pressure. **Conclusion:** Thyroid dysfunction, particularly hypothyroidism, is common in patients with metabolic syndrome. Regular monitoring of thyroid conditions in this population is recommended, as early detection and management of thyroid dysfunction may improve metabolic processes and reduce the risk of cardiovascular disease.

Keywords: Hypothyroidism, Metabolic syndrome, subclinical hypothyroidism, thyroid dysfunction.

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Introduction

Metabolic syndrome is a complex metabolic disorder characterized by a complex of interrelated metabolic abnormalities, including central obesity, insulin resistance, dyslipidemia, and hypertension.[1] The syndrome is recognized as a serious disease burden across the world since it is firmly associated with type 2 diabetes mellitus, cardiovascular diseases, and increased overall mortality.[2]

The etiology of the metabolic syndrome is multifactorial, including genetic, environmental, lifestyle, and hormonal factors. It is commonly perceived that central obesity and lack of insulin resistance are among the causal factors that trigger a range of metabolic imbalances, such as high fasting glucose, atherogenic dyslipidemia, and high blood pressure.[3,4]

The prevalence of metabolic syndrome has greatly grown in recent decades due to a surge in urbanization, sedentary lifestyles, high-energy foods, and soaring obesity levels. According to epidemiological studies in India, the incidence of metabolic syndrome is widely differentiated with place, with 10% to 40 percent in the urban population reported to be at risk of developing cardiovascular diseases and diabetes. Hence, morbidity and mortality are minimized with an early intervention in the condition.[5,6]

The thyroid hormones play a great role in regulating the basal metabolism, energy expenditure, lipid and carbohydrate metabolism, and body weight. Even minor differences in normal thyroid activity may have a drastic effect on metabolic homeostasis.[7] Hypothyroidism, in particular, subclinical hypothyroidism, is associated with weight gain, dyslipidemia, insulin resistance, and elevated blood pressure, which are fundamentals of metabolic syndrome.

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Even though hyperthyroidism is rarely associated with metabolic syndrome, it may influence glucose and lipid metabolism, leading to alterations in insulin sensitivity and energy balance. Thyroid diseases might worsen the symptoms of metabolic syndrome and obesity, and insulin resistance may affect the metabolism of thyroid endocrine hormones and the hypothalamic-pituitary-thyroid axis.[8-10]

Several studies have revealed that there is a high prevalence of thyroid issues in patients with metabolic syndrome. Clinical implications in patients with metabolic syndrome: thyroid dysfunction may worsen metabolic parameters, increase the risk of cardiovascular events, and influence therapy outcomes. As a result, the regular evaluation of thyroid activity in patients with metabolic syndrome is increasingly reflected in clinical guidelines.[11]

Although this association between thyroid dysfunction and metabolic syndrome is gaining momentum, there is limited data on the association between thyroid dysfunction and metabolic syndrome in populations of Indians, in particular, and tertiary care centers where patients often present with multiple comorbidities. Understanding these relations is paramount for diagnosing early stages, risk assessment, and comprehensive treatment of people with metabolic syndrome.

Aims and Objectives

To evaluate the prevalence and pattern of thyroid dysfunction among patients diagnosed with metabolic syndrome.

Materials and Methods

This prospective observational study was carried out at the Department of General Medicine at the Government. Sivagangai Medical College, Sivagangai, Tamil Nadu, over an 8-month duration. Sixty-five patients were enrolled in the trial according to established inclusion and exclusion criteria. Ethical approval for the study was obtained from the Institutional Ethics Committee before initiation, and written informed consent was obtained from all participants. Patients who met the International Diabetes Federation's (IDF) criteria for metabolic syndrome (waist circumference ≥90 cm for men and ≥80 cm for women in South Asian populations) and had central obesity (waist circumference ≥90 cm for men) plus any two of the following criteria were eligible to participate in the study: elevated triglycerides (≥150 mg/dL), reduced HDL cholesterol (<40 mg/dL for men, <50 mg/dL for women), elevated blood pressure (systolic ≥130 mmHg or diastolic ≥85 mmHg), elevated fasting blood glucose (≥100 mg/dL), or a history of type 2 diabetes mellitus.

Exclusion criteria comprised persons with established thyroid disorders, individuals on drugs that may influence thyroid function (including amiodarone, lithium, or steroids), pregnant women, patients with chronic renal disease, and those with any other significant systemic illness. Patients who refused to participate were also excluded.

All registered patients were thoroughly clinically examined. It included a detailed history evaluation, with a focus on signs of thyroid dysfunction (fatigue, weight changes, cold/heat intolerance, alopecia, palpitations, etc.), as well as aspects of metabolic diseases. Standardized anthropometric measures that included height, weight, and waist circumference were taken, and body mass index (BMI) was calculated. Blood pressure was assessed in the sitting position after 5 minutes of rest using a calibrated sphygmomanometer.

All participants underwent laboratory investigations. Sampling: Samples were collected after 8-12 hours of fasting. Blood examination included fasting plasma glucose, lipid (total cholesterol, triglycerides, HDL, LDL), and thyroid (serum thyroid-stimulating hormone (TSH), free triiodothyronine (free T3), and free thyroxine (free T4). Thyroid dysfunction was also categorized according to predefined reference ranges: subclinical hypothyroidism (elevated TSH with normal free T4), overt hypothyroidism (elevated TSH with low free T4), subclinical hyperthyroidism (low TSH with normal free T4), and overt hyperthyroidism (low TSH with high free T4).

The data were recorded and evaluated using SPSS 20.0. Presentation of demographic and clinical parameters was carried out using descriptive statistics, with continuous variables expressed as mean ± standard deviation. Frequencies and percentages were used as expressions to describe categorical variables. The relationship between thyroid dysfunction and the components of metabolic syndrome was analyzed using the Chi-square test for categorical variables and the Student t-test for continuous variables. The p-value of <0.05 was considered statistically significant.

Results

This study involved 65 patients who visited the General Medicine OPD and had metabolic syndrome. The participants were 38 females (58.5) and 27 males (41.5). The average age of the participants was 47.2 with a standard deviation value of 9.3 (28-65 years). Thyroid dysfunction was reported in 29 patients (44.6 per cent), and subclinical hypothyroidism was the prevalent one [Table 1].

Table 1: Distribution of Thyroid Dysfunction in Metabolic Syndrome

Thyroid Status	Number of Patients	Percentage (%)
Euthyroid	36	55.4
Subclinical Hypothyroidism	18	27.7
Overt Hypothyroidism	7	10.8
Subclinical Hyperthyroidism	3	4.6
Overt Hyperthyroidism	1	1.5

The middle-aged group (40 59 years of age) had a higher number of thyroid dysfunctions with a higher number having hypothyroidism indicating the necessity of screening males and females at this age. [Table 3]

Table 2: Thyroid Dysfunction by Gender

Age Group (years)	Euthyroid	Thyroid Dysfunction	p-value
20–39	10	2	0.03*
40–59	18	23	0.01*
≥60	8	4	0.12

Table 3: Thyroid Dysfunction based on gender

Thyroid Status	Male (n=27)	Female (n=38)	p-value
Euthyroid	17	19	0.32
Hypothyroid	8	15	0.04*

Patients with thyroid dysfunction had significantly higher fasting glucose, triglycerides, and waist circumference, indicating worse metabolic profile compared to euthyroid patients. [Table 4]

Table 4: Comparison of Metabolic Parameters with Thyroid Status

Parameter	Euthyroid (n=36)	Thyroid Dysfunction (n=29)	p-value
Fasting Blood Glucose (mg/dL)	108.6 ± 12.4	118.9 ± 15.7	0.002*
Triglycerides (mg/dL)	172.4 ± 35.1	190.5 ± 40.8	0.03*
HDL (mg/dL)	42.8 ± 5.6	39.2 ± 6.1	0.01*
Waist Circumference (cm)	94.5 ± 7.8	99.2 ± 8.3	0.005*
Systolic BP (mmHg)	128.4 ± 10.7	132.6 ± 12.1	0.08
Diastolic BP (mmHg)	82.3 ± 8.5	85.1 ± 9.3	0.12

Both subclinical and overt hypothyroidism were significantly associated with worse metabolic syndrome components, whereas hyperthyroidism had minimal impact due to smaller sample size. [Table 5]

Table 5: Association of Type of Thyroid Dysfunction with Metabolic Syndrome Components

Component	Subclinical Hypo (n=18)	Overt Hypo (n=7)	Hyperthyroid (n=4)	p-value
Elevated Fasting Glucose	13 (72.2%)	6 (85.7%)	1 (25%)	0.01*
Elevated Triglycerides	12 (66.7%)	5 (71.4%)	1 (25%)	0.02*
Low HDL	11 (61.1%)	5 (71.4%)	0 (0%)	0.03*
Elevated Waist Circumference	14 (77.8%)	6 (85.7%)	1 (25%)	0.01*

Patients with thyroid dysfunction were more likely to have 4–5 components of metabolic syndrome, suggesting a cumulative worsening of metabolic risk with thyroid abnormalities. [Table 6]

Table 6: Composite Metabolic Syndrome Risk Score vs Thyroid Dysfunction

Number of Metabolic syndrome Components Present	Euthyroid (n=36)	Thyroid Dysfunction (n=29)	p-value
3 Components	22 (61.1%)	8 (27.6%)	0.01*
4 Components	10 (27.8%)	12 (41.4%)	0.08
5 Components	4 (11.1%)	9 (31.0%)	0.03*

Discussion

Metabolic syndrome is a complex of metabolic abnormalities that significantly increases the likelihood of cardiovascular disease and type 2 diabetes. Thyroid hormones play a crucial role in speech-making in metabolism, and even minimal variations in thyroid functioning probably have enormous impacts on glucose, cholesterol, and energy homeostasis.

The present research established that 44.6 percent of persons with metabolic syndrome depicted thyroid disorders, which were largely severe hypothyroidism. The conclusion was in line with other previous studies that described the prevalence of thyroid impairment of between 30 and 50 percent in patients with metabolic syndrome. The first issue was subclinical hypothyroidism, and it clearly indicates that even slight disruption of thyroid hormone metabolism may have enormous consequences.

Saluja M et al,[13] indicated that out of 100 patients with metabolic syndrome, 37% of them had subclinical hypothyroidism (SCH), 12% overt hypothyroidism, and 2% of the population had overt hyperthyroidism. The study by Awan MF et al,[14] examined 37 (24.66%) of the study subjects and found that thyroid dysfunction occurred in these subjects. There were 11 (16.41) male patients out of 67 with thyroid dysfunction, and 26 (31.32) out of 83 female patients with thyroid dysfunction. The frequency of subclinical hypothyroidism was 4 (2.7%), hypothyroidism was 5 (3.3%), subclinical hyperthyroidism was 20 (13.3%), and hyperthyroidism was 8 (5.3%).

According to a study by Lakhani et al,[15] thyroid dysfunction was found in 23.7% of the total population. Of the thyroid dysfunctions, the subclinical hypothyroidism (SCH) was fairly common at 18.8 percent and the blatant hypothyroidism at 3.8 percent among patients, whereas their subclinical hyperthyroidism was at 1.3 percent among patients.

It was noted that in the current study, thyroid dysfunction was more common amongst females and the age group between 40-59years of age. This is in line with the proven higher frequency of hypothyroidism in women, which may be due to autoimmune

mechanisms and due to age-related changes in thyroid behavior. The results point to the importance of conscientious screening for thyroid disease in middle-aged women with metabolic syndrome. A timely diagnosis in such groups can enable timely intervention, minimizing the progression of metabolic issues.

This paper shows that patients with thyroid dysfunction had significantly higher fasting blood glucose, triglycerides, and waist circumference, but lower HDL cholesterol levels than euthyroid patients. Correlational research established that TSH is positively associated with fasting glucose, triglycerides, waist circumference, and BMI, but negatively associated with HDL and free T4 levels.

Such data suggest that hypothyroidism can exacerbate insulin resistance, central obesity, and dyslipidemia and, therefore, worsen the general metabolic picture. The results are supported by studies showing that thyroid hormones influence insulin sensitivity, liver lipid metabolism, and adipocyte activity, and that hypothyroidism can increase atherogenic risk.

Eshghinia S et al,[16] observed the higher risk of metabolic syndrome among older people (p = 0.001), individuals with high BMI (p = 0.001), increased waist circumference (WC) (p = 0.001), high fasting blood sugar (FBS) (p = 0.001), high systolic blood pressure (SBP) (p = 0.001), high diastolic blood pressure (DBP) (p = 0.001), poor high-density lip

Hassanin H et al,[17] conducted a study developing the findings that out of 602 patients, 23.9% of them had metabolic syndrome, and 8.9% subclinical hypothyroidism (SCH). The prevalence of metabolic syndrome in the euthyroid group and the group with subclinical hypothyroidism was found to be 22.4 and 39%, respectively. In patients with metabolic syndrome, SCH was found in 14.6 percent, and the obstetric system in 7.2 percent of those without it. There was a significant association between metabolic syndrome and SCH (p=0.05). Weight, BMI, and DBP were notable predictors of SCH among patients with metabolic syndrome.

They found that metabolism syndrome elements varied significantly between mildly and considerably raised levels of TSH total cholesterol (P < 0.001) and high density lipoprotein cholesterol (P < 0.05) (Alsulami SS et al).[18] Male subjects with subclinical hypothyroidism had a high tendency of developing diabetes (P < 0.001) and hypertension (P < 0.02) as opposed to female participants with subclinical hypothyroidism.

Additionally, thyroid dysfunction correlated with a higher count of the elements of metabolic syndrome, indicating a progressive impairment of the metabolic defects. This highlights the clinical importance of screening for thyroid abnormalities in patients with metabolic syndrome, as correcting thyroid dysfunction can simultaneously improve multiple metabolic indices.

Conclusion

Thyroid disorders, particularly subclinical and overt hypothyroidism, were common in patients with metabolic syndrome. It showed a moderate correlation with unhealthy metabolic indicators, including elevated fasting glucose, dyslipidemia, central obesity, and high blood pressure. The overload was mostly on female and middle-aged patients. Earlier diagnosis and treatment of thyroid disorders among this group of people were essential to optimizing metabolism, reducing the risk of cardiovascular disease, and improving overall outcomes. Routine thyroid monitoring should be regarded as a fundamental component of metabolic syndrome therapy.

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Conflicts of interest

There are no conflicts of interest.

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