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PREVALENCE OF METABOLIC SYNDROME IN PATIENTS WITH HYPOTHYROIDISM: A HOSPITAL-BASED CROSS-SECTIONAL STUDY FROM CENTRAL INDIA

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ABSTRACT

Background: Hypothyroidism is a common endocrine disorder that influences multiple metabolic processes, including lipid metabolism, body weight, and insulin sensitivity. Metabolic syndrome (MetS), a cluster of cardiovascular risk factors, is increasingly reported in patients with hypothyroidism. **Aim and Objectives:** To determine the prevalence of metabolic syndrome in patients with hypothyroidism and to evaluate associated clinical and biochemical parameters. **Materials and Methods:** This hospital-based cross-sectional observational study was conducted over 12 months. A total of 120 adult patients with biochemically confirmed hypothyroidism were enrolled. Metabolic syndrome was diagnosed using NCEP ATP III criteria. Patients with known diabetes mellitus were excluded; however, fasting glucose criteria were retained for MetS diagnosis. Data were analyzed using SPSS version 27.0. Normality was assessed using the Shapiro–Wilk test. Continuous variables were expressed as mean ± standard deviation (SD), and between-group differences were reported as mean difference with 95% confidence intervals (CI). Categorical variables were compared using Chi-square or Fisher's exact test. A p-value < 0.05 was considered statistically significant. **Results:** The mean age was 44.8 ± 10.6 years, with females comprising 76.7%. The prevalence of metabolic syndrome was 54.2% (95% CI: 45.2–63.0). Patients with MetS had significantly higher BMI (mean difference: 3.7 kg/m²; 95% CI: 2.5–4.9; p < 0.001) and TSH levels (mean difference: 2.7 mIU/L; 95% CI: 1.6–3.8; p < 0.001). **Conclusion:** A high prevalence of metabolic syndrome was observed among hypothyroid patients. These findings suggest a significant association between thyroid dysfunction and metabolic abnormalities.

INTRODUCTION

Metabolic syndrome (MetS) is a cluster of interrelated metabolic abnormalities, including central obesity, insulin resistance, dyslipidemia, and hypertension, which collectively increase the risk of cardiovascular disease and type 2 diabetes mellitus.[1,2] The prevalence of MetS has been steadily rising worldwide, particularly in developing countries such as India, largely due to rapid urbanization, sedentary lifestyles, and dietary changes.[3] Parallel to this, thyroid disorders—especially hypothyroidism—have emerged as one of the most common endocrine disorders, with an estimated prevalence of approximately 10–11% in the Indian population.[4]

Hypothyroidism is characterized by deficient thyroid hormone production, leading to a generalized reduction in metabolic activity. It has significant effects on lipid metabolism, body weight regulation, and insulin sensitivity, thereby contributing to several components of metabolic syndrome.[5] Previous studies have shown that hypothyroid patients frequently exhibit increased body mass index, dyslipidemia, and hypertension, all of which are key features of MetS.[6] Additionally, thyroid-stimulating hormone (TSH) levels have been positively correlated with serum cholesterol and triglyceride levels, suggesting a possible link between thyroid dysfunction and metabolic derangements.[6-8]

Several epidemiological studies have reported an association between hypothyroidism and metabolic syndrome. The prevalence of MetS has been found to

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be higher in hypothyroid individuals compared to euthyroid controls, with reported rates ranging from 40% to 48% across different populations.[8,9] Furthermore, subclinical hypothyroidism, often considered a mild form of thyroid dysfunction, has also been associated with an increased prevalence of MetS and its individual components.[10] This relationship appears to be bidirectional, as individuals with metabolic syndrome may also have an increased risk of developing thyroid dysfunction.[10]

Given the increasing burden of both hypothyroidism and metabolic syndrome, and their combined impact on cardiovascular risk, it is important to evaluate their coexistence in clinical settings. However, data from the Indian population remain limited. Therefore, the present study was conducted to determine the prevalence of metabolic syndrome in patients with hypothyroidism and to evaluate associated clinical and biochemical parameters in a tertiary care center.

MATERIALS AND METHODS

Study Design and Setting

The present study was conducted as a hospital-based cross-sectional observational study in the Department of Medicine at LN Medical College and Research Center, Bhopal, over 12 months. The primary objective was to determine the prevalence of metabolic syndrome among patients diagnosed with hypothyroidism.

Study Population and Sampling

A total of 120 patients with hypothyroidism were included in the study. Patients attending the outpatient and inpatient departments were recruited using a consecutive sampling technique, in which all eligible participants presenting during the study period were enrolled until the required sample size was reached.

Inclusion and Exclusion Criteria

Adult patients aged ≥18 years with a confirmed diagnosis of hypothyroidism were included. Hypothyroidism was defined biochemically as elevated serum thyroid-stimulating hormone (TSH) levels (typically >4.5 mIU/L as per laboratory reference) with or without reduced free thyroxine (FT4) levels.[11] Both overt hypothyroidism (elevated TSH with low FT4) and subclinical hypothyroidism (elevated TSH with normal FT4) were considered.

Patients with known diabetes mellitus, chronic kidney disease, chronic liver disease, pregnancy, those receiving medications affecting lipid metabolism (e.g., corticosteroids, statins), and those with incomplete clinical or laboratory data were excluded. Patients with known diabetes mellitus were excluded to avoid distortion of metabolic syndrome prevalence estimates; however, fasting blood glucose criteria were retained for diagnosis of metabolic syndrome as per NCEP ATP III criteria. This approach may lead to underestimation of the true prevalence.

Sample Size Calculation

The sample size was calculated using the formula:

$$n = \frac{Z^2 \times p \times (1-p)}{d^2}$$

Where:

- Z = 1.96 (for 95% confidence level)
- p = 0.46 (expected prevalence based on previous studies [Meher et al.])
- d = 0.09 (margin of error)

The calculated sample size was approximately 105, which was rounded to 120 to account for possible data loss.

Data Collection and Clinical Assessment

After obtaining written informed consent, demographic and clinical details (age, sex, duration of illness, and treatment history) were recorded using a structured case record form. All participants underwent a comprehensive clinical examination.

Anthropometric measurements were obtained using standardized techniques. Body weight and height were measured using calibrated instruments. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2). Waist circumference was measured at the midpoint between the lower rib margin and the iliac crest using a non-stretchable measuring tape. Blood pressure was measured using a calibrated sphygmomanometer after 5 minutes of rest, and the average of two readings was recorded.

Laboratory Investigations

Venous blood samples were collected after an overnight fast of 8–10 hours. The samples were analyzed for fasting blood glucose, serum triglycerides, high-density lipoprotein (HDL) cholesterol, TSH, and FT4 using standardized automated laboratory methods in the institutional laboratory.

Definition of Metabolic Syndrome

Metabolic syndrome was diagnosed according to the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) criteria, which require the presence of three or more of the following components: Waist circumference >102 cm in males and >88 cm in females, Serum triglycerides ≥150 mg/dL, HDL cholesterol <40 mg/dL in males and <50 mg/dL in females, Blood pressure ≥130/85 mmHg or on antihypertensive treatment, Fasting blood glucose ≥100 mg/dL.[13] Overt hypothyroidism: TSH >10 mIU/L with low FT4 and Subclinical hypothyroidism: TSH 4.5–10 mIU/L with normal FT4. Although lower waist circumference cut-offs are recommended for Asian populations, NCEP ATP III criteria were used for consistency with previous studies.

Statistical Analysis

Data was entered into Microsoft Excel and analyzed using SPSS version 27.0. Normality of distribution was assessed using the Shapiro–Wilk test. Continuous variables were expressed as mean ± standard deviation (SD) or median (interquartile range), as appropriate. Comparisons between groups

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were performed using Student's t-test or Mann–Whitney U test. Categorical variables were presented as frequencies and percentages and compared using Chi-square or Fisher's exact test. Mean differences were reported with 95% confidence intervals. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 120 patients with hypothyroidism were included in this study conducted at the Department of Medicine, LN Medical College and Research Center, Bhopal. The mean age of the study population was 44.8 ± 10.6 years. The majority of patients belonged to the 40–59 years age group (52.5%), followed by 20–39 years (30.0%) and ≥60 years (17.5%). Females accounted for 76.7% of the study population. [Table 1]

Table 1: Baseline Demographic Characteristics of Study Population (n = 120)

Variable	Category	Frequency (%)
Age group (years)	20–39	36 (30.0)
	40–59	63 (52.5)
	≥60	21 (17.5)
Gender	Male	28 (23.3)
	Female	92 (76.7)
Mean Age (years)	—	44.8 ± 10.6

The overall prevalence of metabolic syndrome (MetS) among hypothyroid patients was found to be 54.2% (65/120). The prevalence of metabolic syndrome was 54.2% (95% CI: 45.2–63.0).

In gender-based analysis, metabolic syndrome was more frequent among females (57.6%) than males (42.9%); however, the difference was not statistically significant (p = 0.18). [Table 2]

Table 2: Gender-wise Distribution of Metabolic Syndrome

Gender	MetS Present n (%)	MetS Absent n (%)	p-value
Male (n = 28)	12 (42.9)	16 (57.1)	0.18
Female (n = 92)	53 (57.6)	39 (42.4)	

Statistical Test: Chi-square test

Analysis of the individual components of metabolic syndrome revealed that central obesity was the most prevalent abnormality (65.0%), followed by reduced HDL cholesterol (60.0%), hypertriglyceridemia (55.0%), hypertension (48.3%), and elevated fasting blood glucose (43.3%). [Table 3]

Table 3: Distribution of Components of Metabolic Syndrome (n = 120)

Component	Frequency (%)
Central Obesity	78 (65.0)
Reduced HDL	72 (60.0)
Hypertriglyceridemia	66 (55.0)
Hypertension	58 (48.3)
Elevated Fasting Glucose	52 (43.3)

Patients with metabolic syndrome had significantly higher BMI, TSH levels, triglycerides, and fasting blood glucose compared to those without metabolic syndrome (all p < 0.001). [Table 4]

These findings suggest an association between higher TSH levels and metabolic abnormalities.

Table 4: Comparison of Clinical Parameters Between MetS and Non-MetS Groups

Parameter	MetS Present (n = 65)	MetS Absent (n = 55)	p-value
BMI (kg/m²)	28.6 ± 3.8	24.9 ± 3.1	0.0001
TSH (mIU/L)	9.8 ± 3.2	7.1 ± 2.6	0.0001
Triglycerides (mg/dL)	186.4 ± 32.5	132.8 ± 28.6	0.0001
Fasting Glucose (mg/dL)	118.6 ± 18.2	96.3 ± 14.5	0.0001

Statistical Test: Independent t-test

Table 5: Logistic Regression Analysis for Predictors of MetS

Variable	OR	95% CI	p-value
BMI	1.28	1.12–1.46	0.001
TSH	1.18	1.06–1.32	0.003
Female gender	1.52	0.72–3.21	0.27

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BMI and TSH were independently associated with metabolic syndrome, whereas gender was not a significant predictor. [Table 5]

DISCUSSION

The present study evaluated the prevalence of metabolic syndrome (MetS) among patients with hypothyroidism and demonstrated a high prevalence of 54.2%, indicating a substantial burden of metabolic abnormalities in this population. This finding is consistent with previous studies that have reported an increased prevalence of metabolic syndrome in hypothyroid individuals compared to the general population.[1,2]

In the current study, the majority of patients were in the middle-aged group (40–59 years) with a female predominance (76.7%). This observation aligns with earlier epidemiological data indicating that hypothyroidism is more common in females and tends to present more frequently in middle-aged individuals.[4] The higher prevalence of MetS observed in females (57.6%) compared to males (42.9%) in our study, although not statistically significant, is in agreement with findings reported by Erdogan M et al., who also demonstrated a higher prevalence of metabolic syndrome among female hypothyroid patients.[6]

The overall prevalence of metabolic syndrome (54.2%) in our study is comparable to that reported in other studies. Erdogan M et al. reported a prevalence of approximately 44%, while Meher LK et al. observed a prevalence of around 46% among hypothyroid patients.[6,14] Slight variations in prevalence across studies may be attributed to differences in study population characteristics, diagnostic criteria, and geographic factors.

Among the individual components of metabolic syndrome, central obesity (65.0%) was the most prevalent abnormality in our study, followed by reduced HDL cholesterol (60.0%) and hypertriglyceridemia (55.0%). These findings are consistent with the known pathophysiological effects of hypothyroidism on lipid metabolism and body weight regulation. Thyroid hormones play a crucial role in lipid homeostasis, and their deficiency leads to decreased lipid clearance, increased serum triglycerides, and reduced HDL levels.[5] Similar observations have been reported by Rizos CV et al., who emphasized the significant association between hypothyroidism and dyslipidemia.[5]

In the present study, patients with metabolic syndrome had significantly higher BMI, TSH levels, triglyceride levels, and fasting blood glucose than those without metabolic syndrome ($p < 0.001$). These findings suggest a significant association between the severity of thyroid dysfunction and metabolic derangements. A positive correlation between TSH levels and metabolic parameters has also been reported in previous studies, indicating that even mild thyroid dysfunction are associated with metabolic risk.[15] Bermúdez et al. demonstrated that increasing TSH levels were associated with a higher prevalence of metabolic syndrome and its components, particularly central obesity and dyslipidemia.[15]

Another important observation from our study is the higher prevalence of metabolic syndrome in patients with overt hypothyroidism compared to those with subclinical hypothyroidism. However, the difference was not statistically significant. This trend has been similarly reported in earlier studies, suggesting that the degree of thyroid hormone deficiency may influence the severity of metabolic abnormalities.[7]

The association between hypothyroidism and metabolic syndrome is likely multifactorial. Reduced basal metabolic rate, altered lipid metabolism, insulin resistance, and endothelial dysfunction are associated with the development of metabolic syndrome in hypothyroid patients.[5,16] Additionally, metabolic syndrome itself may predispose individuals to thyroid dysfunction, indicating a possible bidirectional relationship.[10]

Given the high prevalence of metabolic syndrome observed in this study, routine screening for metabolic abnormalities in patients with hypothyroidism is strongly recommended. Early identification and management of these risk factors may help reduce the long-term risk of cardiovascular morbidity and mortality.

The study has several limitations. First, known diabetic patients were excluded, which may have led to an underestimation of the true prevalence of metabolic syndrome. Second, the absence of a control group limits comparison with euthyroid individuals. Third, regression analysis was limited, and residual confounding cannot be ruled out. Additionally, dietary habits and lifestyle factors were not assessed, which may influence metabolic parameters. Finally, being a hospital-based study, the findings may be subject to selection bias and may not be generalizable to the community population.

CONCLUSION

This study demonstrates a high prevalence of metabolic syndrome among patients with hypothyroidism. Central obesity and dyslipidemia were the most common components, and patients with metabolic syndrome had higher BMI, TSH levels, and adverse metabolic parameters. These findings suggest an association between thyroid dysfunction and metabolic abnormalities. Routine screening for metabolic syndrome in hypothyroid patients may help enable early identification and management of cardiovascular risk factors.

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