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Original Research Article

Frequency of Hypothyroidism Among Patients With Metabolic Syndrome Attending a Tertiary Care Hospital

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Abstract: *Metabolic syndrome is a major public health problem and is associated with several endocrine abnormalities, including thyroid dysfunction. Hypothyroidism may worsen the metabolic profile and contribute to adverse cardiovascular risk in affected patients.* ***Objective:*** *To determine the frequency of hypothyroidism among patients with metabolic syndrome.* ***Methods:*** *This study was conducted on 198 patients aged 25 to 70 years, of both genders, presenting with metabolic syndrome in the Department of General Medicine, Mardan Medical Complex, Mardan, from 01-11-2024 to 01-02-2025. Metabolic syndrome was diagnosed when any three of the following criteria were fulfilled, serum triglyceride ≥ 150 mg/dl (1.7 mmol/l), HDL cholesterol < 40 mg/dl in men, and < 50 mg/dl in women, blood pressure ≥ 130/85 mmHg, and fasting blood glucose > 110 mg/dl. Pregnant women, patients with cardiovascular disease, those on corticosteroids, and patients with active liver disease or renal dysfunction were excluded. Hypothyroidism was assessed in all patients, defined by the presence of fatigue, weight gain, cold intolerance, and constipation, along with a TSH level > 4.0 to 5.0 mIU/L. Data were analysed using SPSS 25. Post-stratification chi-square or Fisher's exact test was applied at a 5% significance level.* ***Results:*** *The study enrolled 198 patients with metabolic syndrome; their mean age was 49.73±13.31 years, and their mean BMI was 28.01±2.57 kg/m². Mean serum TSH level was 3.755±0.541 mIU/L Females were 111 (56.1%). Hypothyroidism was identified in 57 (28.8%) patients. A statistically significant association was observed between female gender and hypothyroidism (p=0.001).* ***Conclusion:*** *The frequency of hypothyroidism in patients with metabolic syndrome was 57 (28.8%). The female gender was significantly associated with hypothyroidism.*

Keywords: Metabolic syndrome, hypothyroidism, Thyroid Stimulating Hormone, Serum triglyceride

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Introduction

The aggregation of peripheral vascular illnesses, insulin resistance, and type II diabetes mellitus (T2DM) that increases the risk of atherosclerotic cardiovascular disease is known as metabolic syndrome. Atherogenic dyslipidemia, insulin resistance, hypertension, and central obesity are among the metabolic diseases that collectively establish metabolic syndrome (1). Compared to the general population, patients with metabolic syndrome are expected to have a 5-fold greater risk of diabetes mellitus and a 2-fold increased risk of atherosclerotic cardiovascular illnesses (2). Accelerated atherosclerosis, early-onset T2DM, and premature atherosclerotic cardiovascular illnesses are also related to metabolic syndrome (3). The main feature of metabolic syndrome is abdominal fat accumulation, which causes insulin resistance. The secreted pro-inflammatory cytokines from increased adipose tissue negatively affect insulin (4).

Low thyroid hormone levels with a diversity of causes and symptoms lead to hypothyroidism. The thyroid gland is unable to produce enough thyroid hormone in those with primary hypothyroidism (5). A study observed the frequency of hypothyroidism (31.9 %) among patients with metabolic syndrome (6). While hypothyroidism stems from hypothalamic dysfunction, secondary hypothyroidism is less prevalent and occurs when the thyroid gland functions normally (7). Thyroid hormones are essential for regulating lipid metabolism and metabolism more generally. The slower metabolic rate associated with hypothyroidism can exacerbate weight gain, insulin resistance, and dyslipidemia, further exacerbating the severity of metabolic syndrome (8). Peripheral thyroxine conversion to the more active triiodothyronine may be hindered by the inflammatory state and metabolic disturbances associated with metabolic syndrome, which may result in subclinical or overt hypothyroidism (9,10).

Metabolic syndrome, characterized by a cluster of metabolic disturbances including obesity, hypertension, dyslipidemia, and insulin resistance, presents a complex clinical scenario that may be exacerbated by hypothyroidism, an endocrine disorder marked by insufficient thyroid hormone production. There is no such study available on this subject locally. This study aims to determine the frequency of hypothyroidism among patients with metabolic syndrome at our health setup. The results of this study are crucial for our medical professionals in understanding the bidirectional relationship between these conditions, which is crucial for developing effective management strategies. Investigating this interplay could lead to improved diagnostic protocols and therapeutic approaches, enhancing overall patient care and potentially mitigating the heightened metabolic risks associated with these coexisting conditions.

Methodology

This cross-sectional study was conducted in the Department of General Medicine at Mardan Medical Complex, Mardan, from 01-11-2024 to 01-02-2025, after obtaining ethical approval from the hospital. The sample size of the present study was 198. Sample size was calculated using the WHO sample size calculator, taking the following assumptions: frequency of hypothyroidism in patients with metabolic syndrome 31.9%, (7) margin of error 6.5%, and confidence interval 95%. Non-probability consecutive sampling was used.

Patients aged 25 to 70 years, of both genders, presenting with metabolic syndrome were enrolled. Metabolic syndrome was labelled positive for patients fulfilling any 3 of the following criteria, serum triglyceride ≥ 150 mg/dl (1.7 mmol/l) on laboratory assessment, HDL cholesterol < 40 mg/dl in men, and < 50 mg/dl in women on laboratory assessment, blood pressure ≥ 130/85 mmHg on sphygmomanometer and fasting blood

glucose > 110 mg/dl on laboratory assessment. Pregnant patients, those with cardiovascular disease, corticosteroid use, patients with active liver disease, and those with renal dysfunction were excluded.

Patients who met the study's selection criteria were enrolled. Informed written consent forms were obtained from all enrolled patients after briefing them about the goal and benefits of this study. They were assured that no risk was involved while participating in this study. Demographic data, including age, BMI, gender, educational status, profession, socioeconomic status, and residential area, were recorded. Patients diagnosed with metabolic syndrome were examined for hypothyroidism, which was defined in patients presenting with all of the following symptoms: fatigue, weight gain, cold intolerance, and constipation. Diagnosis was achieved by conducting a blood test, observing a TSH level > 4.0-5.0 mIU/L, for the diagnosis of hypothyroidism. 5 mL of blood was taken aseptically from the vein of the arm by using the needle/syringe and preserved in a sterile vial for laboratory assessment. Under the guidance of a consultant with at least 5 years of post-fellowship experience, a complete assessment was performed, and patients' details were recorded on a pre-designed structured proforma.

SPSS 25 software was used to analyze the data. Mean and SD were calculated for numerical variables such as age, serum TSH level, and BMI. Frequencies and percentages were determined for categorical variables such as gender, hypothyroidism, education status, profession, socioeconomic status, and residence area. Hypothyroidism was stratified by age, gender, BMI, education status, profession, socioeconomic status, and residence area to address the effect modifiers. Post-stratification Chi-square or Fisher's exact test was applied at the 5% significance level. Results will be demonstrated in the form of tables.

Results

This study enrolled 198 patients with metabolic syndrome. The mean age of the patients was 49.73 ± 13.31 years. The mean body mass index was 28.01 ± 2.57 kg/m². Mean serum TSH level was 3.755±0.541 mIU/L.

Among all patients, 111 (56.1%) were females, and 87 (43.9%) were males. Regarding educational background, 108 (54.5%) were illiterate, while 90 (45.5%) were literate. The remaining demographic distribution is presented in Table 1.

The frequency of hypothyroidism in this study was 57 (28.8%), while 141 (71.2%) patients did not have hypothyroidism (Table 2).

The study did not find any significant relationship between hypothyroidism and age, BMI, socioeconomic status, residence, education status, or profession. However, a significant relationship was observed between hypothyroidism and female gender; among the patients with hypothyroidism, 42 (73.7%) were female, and only 15 (26.3%) were male (p = 0.001) (Table 3).

Table 1: Demographics

Demographics		n	%
Gender	Male	87	43.9%
	Female	111	56.1%
Education status	Literate	90	45.5%
	Illiterate	108	54.5%
Profession	Labour	48	24.2%
	Retired	49	24.7%
	Office job	48	24.2%
	other	53	26.8%
Residence	Urban	110	55.6%
	Rural	88	44.4%
Socioeconomic status	Lower class	85	42.9%
	Middle class	80	40.4%
	Upper class	33	16.7%

Table 2: Frequency of hypothyroidism

Hypothyroidism	n	%
Yes	57	28.8%
No	141	71.2%

Table 3: Stratification of hypothyroidism with demographics

		Hypothyroidism				P value
		Yes		No		
		n	%	n	%	
Age distribution (Years)	25 to 40	22	38.6%	39	27.7%	0.320
	41 to 55	13	22.8%	38	27.0%	
	> 55	22	38.6%	64	45.4%	
BMI distribution (kg/m2)	18.5 to 24.9	11	19.3%	18	12.8%	0.239
	> 24.9	46	80.7%	123	87.2%	
Gender	Male	15	26.3%	72	51.1%	0.001
	Female	42	73.7%	69	48.9%	
Education status	Literate	25	43.9%	65	46.1%	0.447
	Illiterate	32	56.1%	76	53.9%	
Profession	Labour	13	22.8%	35	24.8%	0.975
	Retired	14	24.6%	35	24.8%	
	Office job	15	26.3%	33	23.4%	
	other	15	26.3%	38	27.0%	
Residence	Urban	26	45.6%	84	59.6%	0.073

	Rural	31	54.4%	57	40.4%	
Socioeconomic status	Lower class	24	42.1%	61	43.3%	0.948
	Middle class	24	42.1%	56	39.7%	
	Upper class	9	15.8%	24	17.0%	

Discussion

The existing research demonstrates a higher prevalence of thyroid dysfunction, especially subclinical hypothyroidism, among patients diagnosed with metabolic syndrome. Badri et al. reported a prevalence of subclinical hypothyroidism of 30.1% in their study, with the majority of affected patients being females and belonging to the 41 to 50 years age group. (11) Verma et al. observed an even higher frequency of hypothyroidism at 46.5% among metabolic syndrome patients, of which subclinical hypothyroidism accounted for 29.9% and overt hypothyroidism for 16.6%. (12) In their study, females were 58.9% of the hypothyroid group, reinforcing the gender disparity noted across multiple studies.

Aljabri and associates in a large retrospective study from Saudi Arabia involving 1556 metabolic syndrome cases found hypothyroidism in 21.8% of patients with a female predominance of 72.6%. This pattern aligns with the understanding that females are disproportionately affected by thyroid disorders, possibly due to hormonal influences and higher susceptibility to autoimmune processes. (13)

Mawlud and associates identified a significant association between thyroid dysfunction and elevated triglyceride levels, noting that 73.3% of hypothyroid patients exhibited hypertriglyceridemia compared to 51.7% of euthyroid patients. Furthermore, a statistically significant association was observed between metabolic syndrome and thyroid nodules, suggesting that structural thyroid abnormalities may be more common in this population. (14) Verma et al found that patients with hypothyroidism had significantly higher total cholesterol and triglyceride levels alongside lower high-density lipoprotein cholesterol when compared to euthyroid metabolic syndrome patients. (12) Khatiwada et al. reported that subclinical hypothyroidism was the commonest thyroid dysfunction in their metabolic syndrome patients, affecting 26.6% of participants. They noted a significant negative correlation between thyroid-stimulating hormone levels and HDL cholesterol. The relative risk of thyroid dysfunction in females was 1.525 compared to males, although this did not reach statistical significance. (7) These findings collectively indicate that the metabolic derangements seen in hypothyroidism, particularly dyslipidemia and central adiposity, overlap considerably with the diagnostic criteria for metabolic syndrome.

In the present study, the frequency of hypothyroidism among patients with metabolic syndrome was 28.8%. This figure is comparable to the 31.9% observed by Khatiwada et al. and 30.1% reported by Badri et al. and although it is somewhat lower than the 46.5% documented by Verma et al. and higher than the 21.8% found by Aljabri et al.(7,11,12,13) The mean age of the patients was 49.73±13.31 years which aligns with the mean ages reported in other studies such as 48.1±17.01 years by Verma and associates and 48.3±9.2 years by Khan et al. (12,15) The mean BMI of 28.01±2.57 kg/m2 in the present study indicates that the majority of patients were overweight, which is consistent with the central obesity component of metabolic syndrome. Female predominance was observed, with 56.1% of the total sample being women and 73.7% of hypothyroid patients being female. This female predominance is consistent with previous reports by Aljabri et al., who found 72.6% female representation in their metabolic syndrome cohort. (13)

Conclusion

In conclusion, the present study found that the frequency of hypothyroidism in patients with metabolic syndrome was 57 (28.8%). A statistically significant association was observed between hypothyroidism and female gender. Routine screening for thyroid dysfunction should be considered for all newly diagnosed patients with metabolic syndrome, regardless of the presence or absence of classic hypothyroid symptoms. Such screening is particularly important for women, given the consistently higher prevalence observed across multiple studies.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned.
Consent for publication
Approved
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Not applicable

Conflict of interest

The authors declared no conflict of interest.

Author Contribution

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Data analysis, and critical guidance.
WAK (Postgraduate Resident)
Development of Research Methodology
SAAJ (Postgraduate Resident)
Critical input.
AK (Postgraduate Resident)
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FR (Assailant Professor)
Helps in interpretation of data

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the study's integrity.

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