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ORIGINAL RESEARCH

THYROID DYSFUNCTION IN PATIENTS WITH METABOLIC SYNDROME IN A TERTIARY HEALTH CARE CENTRE

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Abstract

Background: Thyroid dysfunction, prominently subclinical hypothyroidism has been observed more frequently in metabolic syndrome patients than in the general population. The presence of both conditions could also increase the risk for cardiovascular diseases and considerable overlap occurs in the pathogenic mechanisms of atherosclerotic cardiovascular disease (CVD) by metabolic syndrome and hypothyroidism. The researchers wanted to evaluate the magnitude of overlap between these two groups and highlight the importance of thyroid function tests in identifying thyroid dysfunction in these groups.

Materials and methods: This was a prospective observational study conducted among 122 patients with metabolic syndrome over a period of 15 months from March 2020 to June 2021 in the Department of Medicine, TDMC, Alappuzha after obtaining ethical committee clearance from the Institutional Ethical Committee and informed written consent from study participants.

Results: A total of 122 patients were taken. In which, 41.8% were between 41 to 50 years with a female preponderance. Of the patients 51.6% were having thyroid dysfunction, 35.2% had subclinical hypothyroidism, 13.9% had overt hypothyroidism and 2.5 % were having hyperthyroidism. There were no patients with subclinical hyperthyroidism. A significant association between thyroid dysfunction and body mass index (BMI) was observed. There was no evidence of any relationship between thyroid status and all the components of metabolic syndrome. There were 3 patients with thyroid stimulating hormone (TSH)>50mU/L and one patient with TSH>100mU/L.

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Conclusion: Thyroid dysfunction is common in patients with metabolic syndrome; most of them had subclinical hypothyroidism rather than overt hypothyroidism. Although thyroid hormones significantly affect each component of metabolic syndrome, there was no relationship between thyroid dysfunction and all of the components of metabolic syndrome. Half of the patients had thyroid dysfunction and the coexistence of two disease entities might substantially increase the risk of type 2 diabetes mellitus and atherosclerotic cardiovascular diseases and this indicates the need for investigating the presence of thyroid dysfunction in patients who have metabolic syndrome.

Keywords: Thyroid Dysfunction, BMI, Metabolic Syndrome.

Introduction

Metabolic syndrome represents a cluster of metabolic abnormalities that include hypertension, central obesity, insulin resistance, and atherogenic dyslipidaemia, and is also strongly associated with an increased risk of developing diabetes and atherosclerotic and non-atherosclerotic cardiovascular disease. The pathogenesis of metabolic syndrome involves genetic and acquired factors contributing to the final inflammation pathway leading to CVD. Recently, metabolic syndrome has gained significant importance due to the exponential increase in obesity worldwide. There is a wide variation in prevalence based on age, gender, race/ethnicity, and the criteria used for diagnosis. Early diagnosis is important in order to employ lifestyle and risk factor modification.

Thyroid dysfunction is also one of the common endocrine disorders which can disturb lipid and glucose metabolism, blood pressure and body weight and is considered to be an independent risk factor for cardiovascular diseases. About 300 million people in the world are affected by thyroid dysfunction and over half are unaware of their condition. It has been estimated that 42 million people in India suffer from thyroid disorders.

The presence of both conditions may be compounded to increase the risk for cardiovascular disease and considerable overlap occurs in the pathogenic mechanisms of atherosclerotic cardiovascular disease by metabolic syndrome and hypothyroidism. So, a study on thyroid dysfunction in people with metabolic syndrome may help us to know the magnitude of overlap of these two groups and may highlight the importance of thyroid function tests in identifying thyroid dysfunction in these groups. This can help us in proper planning and adequate management strategies, which can result in significant reduction in cardiovascular morbidity and mortality due to metabolic syndrome through effective thyroid replacement therapy. This study is done to know the prevalence and the type of thyroid dysfunction in patients with metabolic syndrome.

Objectives

Primary

- To study the prevalence of thyroid dysfunction in patients with metabolic syndrome attending Govt. T.D Medical College, Alappuzha.

Secondary

- To find out the type of thyroid dysfunction in metabolic syndrome.

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Materials and methods

This was a prospective observational study conducted among 122 patients with metabolic syndrome over a period of 15 months from March 2020 to June 2021 in the Department of Medicine, T.D. Medical College, Alappuzha after obtaining ethical committee clearance from the Institutional Ethical Committee and informed written consent from study participants.

Inclusion Criteria

1. Patients of age more than 18 years.
2. Patients with metabolic syndrome and newly detected metabolic syndrome patients by IDF (International Diabetes Federation) criteria.

Exclusion Criteria

Known hypothyroid or sub-clinical hypothyroid or hyperthyroidism patients.

Methods of Data Collection

Proforma containing clinical history and examination was used to collect the data. Sphygmomanometer, measuring tape and weighing machine were used.

Statistical Methods

All the collected data were checked and verified thoroughly to reduce inconsistency. The data was edited, coded and entered into the statistical package for the social sciences (SPSS) PC program. Frequency tables, percentages and means were used as descriptive statistics. The percentage was calculated for categorical variables.

Results

A total of 122 patients with metabolic syndrome according to IDF criteria satisfying the inclusion criteria were enrolled in the study after obtaining consent from patients and relatives. The data obtained was analysed.

Out of 122 patients, 3(2.5%) belonged to underweight with BMI of <18.5,71(58.2%) belonged to the normal range, 37(30.3%) belonged to overweight with BMI of 25 to 29.9 and 11(9%) were obese with a BMI of >30.

SBP	**Frequency**	**Percent**
90-110	10	8.2
111-130	47	38.5
131-150	59	48.4
151-170	6	4.9
Total	122	100
DBP	**Frequency**	**Percent**
65-74	18	14.8
75-84	52	42.6
85-94	48	39.3
➢ 95	4	3.3

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Total	122	100
Fasting Plasma Sugar	**Frequency**	**Percent**
60-80	6	4.9
81-100	45	36.9
101-120	61	50
121-140	9	7.4
➢ 141	1	0.8
Total	122	100
Triglyceride	**Frequency**	**Percent**
100-150	35	28.7
151-200	35	28.7
201-250	47	38.5
251-300	5	4.1
Total	122	100
HDL	**Frequency**	**Percent**
30-39	36	29.5
40-49	45	36.9
50-59	34	27.9
60-69	7	5.7
Total	122	100

Table 1. Distribution of Patients According to Systolic BP, Triglyceride, Diastolic BP, Fasting Plasma Sugar, and High-Density Lipoprotein (HDL)

In the study population, 65(53.3%) patients had systolic BP >130mm of Hg, 10(8.2%) patients had systolic BP recording of 90-110 mm of Hg and 47(38.5%) patients had systolic BP recording of 110-130mm of Hg.

In the present study, 52(42.6%) patients had diastolic BP >85mm of Hg and 52(42.6%) had diastolic BP recording of 75-84 and 18(14.8%) had diastolic BP in the range 65-74.

In the present study, 61(50%) patients had fasting plasma sugar of 101-120,10(8.2%) patients had fasting plasma sugar >120, 45(36.9%) patients had values ranging from 81-100 and 6 (4.9%) patients had a value ranging from 60-80.

In our study population, 35(28.7%) patients had triglyceride values of 100-150, other 35(28.7%) patients had values ranging from 151-200 and 52(42.6%) patients had triglyceride values.

In the present study, 36(29.5%) patients had low HDL of value <40, 45(36.9%) patients had HDL of 40 – 49, 34(27.9%) had HDL of 50-59 and 7(5.7%) patients had HDL of value>60.

TSH	**Frequency**	**Percent**
0-2.5	26	21.3
2.6-5	39	32
5.1-7.5	17	13.9
➢ 7.6	40	32.8
Total	122	100

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Table 2. Distribution of Patients According to S.TSH

In the study population, 57(46.7%) patients had elevated TSH values >5, 39(32%) patients had TSH values ranging from 2.6-5 and 26(21.3%) patients had TSH values <2.5%.

Thyroid Status	Frequency	Percent
Euthyroid	59	48.4
Hyperthyroidism	3	2.5
Hypothyroidism	17	13.9
Subclinical hypothyroidism	43	35.2
Total	122	100

Table 3. Distribution of Patients According to Thyroid Status

In our study of 122 patients, 43(35.2%) patients had subclinical hypothyroidism, 17 (13.9) patients had overt hypothyroidism, 3(2.5%) patients were hyperthyroid and 59(48.4%) patients were euthyroid.

	Variable	Euthyroid (N=59)	Hypothyroid (N=60)	Hyperthyroid (N=3)	P value
Sex-no (%)	**Male**	28(47.5)	23(38.3)	1(33.3)	0.571
	Female	31(52.5)	37(61.7)	2(66.7)	
	Correlation of Sex with Thyroid Dysfunction				
BMI- no (%)	**<18.5**	0	1(1.7)	2(66.7)	<0.001*
	18.6-24.9	40(67.8)	30(50)	1(33.3)	
	25-29.9	18(30.5)	19(31.7)	0	
	30-34.9	1(1.7)	10(16.7)	0	
Correlation of BMI with Thyroid Dysfunction					

Table 4. Correlation of Sex and BMI with Thyroid Dysfunction

Out of 122 patients, 63 patients had thyroid dysfunction. Out of which, 60 were hypothyroid. 37(61.7%) were females and 23(38.3%) were males. Out of 3 hyperthyroid patients, 2 were females. There was no statistically significant association between male and female subjects suffering from thyroid dysfunction.

Out of 60 hypothyroid patients, 19(31.7%) were overweight and 10(16.7%) were obese. There was a statistically significant association between BMI and thyroid dysfunction with a p-value of <0.05

		Euthyroid	Thyroid Status Hyperthyroidism	Hypothyroidism	Subclinical Hypothyroidism	Total	P value (Fisher's Exact Test)
Waist Circumference	80-89	19	2	7	14	42	.361
	90-99	31	0	6	18	55	
	100-109	9	1	4	11	25	
SBP	90-110	6	1	0	3	10	.557
	111-130	18	1	8	20	47	

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	131-150	32	1	8	18	59	
	151-170	3	0	1	2	6	
DBP	65-74	8	1	3	6	18	.874
	75-84	22	1	9	20	52	
	85-94	26	1	5	16	48	
	➢ 95	3	0	0	1	4	
Fasting Plasma Sugar	60-80	3	0	0	3	6	.347
	81-100	19	3	9	14	45	
	101-120	33	0	6	22	61	
	121-140	4	0	2	3	9	
	➢ 141	0	0	0	1	1	
Triglyceride	100-150	14	1	3	17	35	.842
	151-200	18	1	5	11	35	
	201-250	24	1	8	14	47	
	251-300	3	0	1	1	5	
	30-39	18	0	5	13	36	
HDL	40-49	19	2	8	16	45	.720
	50-59	17	1	3	13	34	
	60-69	5	0	1	1	7	
	0-0.3	1	0	11	0	12	
	0.4-0.7	0	0	5	0	5	
FreeT4	0.8-1.1	28	0	0	13	41	.0001
	1.2-1.5	26	1	1	25	53	
	1.6-1.9	3	0	0	5	8	
	➢ 1.9	1	2	0	0	3	
	0-2.5	22	2	1	1	26	
TSH	2.6-5	36	1	0	2	39	.0001
	5.1-7.5	0	0	4	13	17	
	➢ 7.6	1	0	12	27	40	

Table 5. Components of Metabolic Syndrome among Different Thyroid Dysfunction Groups

Each of the components of metabolic syndrome was studied and the relation of these individual components with thyroid dysfunction was detailed. None of them were statistically significant, because of the limited number of study subjects.

Discussion

This study was a cross-sectional study conducted to assess thyroid dysfunction in patients with metabolic syndrome. In the present study, the prevalence of thyroid dysfunction in metabolic syndrome patients was 51.6%. There were many studies conducted across the world including India, the Middle East and African countries[1] and Nepal[2]and the prevalence in these studies were in the range of 21 – 51%.

In the study, we included 122 patients according to the IDF criteria and patients satisfying inclusion and exclusion criteria.

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In our study, out of 122 patients, 41.8% belonged to the age group of 41 to 50. The least number of patients were from the 18 to 30 group. 22(18%) patients belonged to the age group 31 - 40,51-60 and 61-70 age groups.

The study population consisted of 57.4% (n=70) females and 42.6%(n=52) males, with a male to female ratio of 0.74:1. Out of 122 patients, 63 patients had thyroid dysfunction and 60 were hypothyroid. 37(61.7%) were females and 23(38.3%) were males. Out of 3 hyperthyroid patients, 2 were females. There was no statistically significant association between male and female subjects suffering from thyroid dysfunction.

Out of 122 patients, 3 (2.5%) belonged to underweight with a BMI of <18.5,71(58.2%) belonged to the normal range, 37 (30.3%) belonged to overweight with BMI of 25 to 29.9 and 11 (9%) were obese with a BMI of >30. A cross-sectional study done by Meher et al. in 100 patients showed a significant association with subclinical hypothyroidism in patients with metabolic syndrome with a P value of 0.006[3]. Knudsen et al. study done in Algeria has shown that even small differences in thyroid function are associated with changes in BMI.[4] A study done by Hamlaoui et al. also found higher BMI in patients with hypothyroidism and metabolic syndrome.[5] A review article by Pearce et al. showed 0.9 kg increase in weight and a 0.3 kg/m2 increase in BMI in women for every 1 mIU/L increase in baseline TSH serum, and 0.8 kg increase in weight and 0.2 kg/m2 in BMI in men[6]

Examining the prevalence of metabolic syndrome in subclinical and overt hypothyroidism, Erdogan et al. showed a statistically significant difference in BMI between patients with subclinical hypothyroidism and euthyroid subjects [7]

In the present study, 42(34.4%) had waist circumference between 80 and 89cm. 55(45.1%) had waist circumference of 90 – 99cm and 25(20.5%) had waist circumference >100cm.

In the present study population, 65 (53.3%) patients had systolic BP >130 and 10 (8.2%) patients had systolic BP recording of 90-110 and 47(38.5%) patients had systolic BP of 110-130. Ittermann et al. reported a positive relationship between serum TSH levels and hypertension in children and adolescents, suggesting that subclinical hypothyroidism is associated with an increased risk of hypertension. [8]

In the present study, 52(42.6%) patients had diastolic BP of >85mm of Hg and 52(42.6%) had diastolic BP of 75-84 and 18(14.8%) had diastolic BP in the range 65-74. There are reports showing significantly increased diastolic blood pressure in patients with elevated TSH compared to the euthyroid population [9]. 50% of subjects with elevated TSH had diastolic blood pressure above 90 mmHg and only 10% of the euthyroid persons had diastolic BP above 90. Saltiki et al. showed that in euthyroid individuals, the association of thyroid function with diastolic arterial pressure remains significant even when a stricter normal range for TSH levels is considered [10] Asvold et al. found a significant association between serum TSH and blood pressure, diastolic blood pressure in men and women, and systolic blood pressure only in women. [11]

In the present study, 61(50%) patients had fasting plasma sugar of 101-120, and out of 122,10(8.2%) patients had fasting plasma sugar >120, and 45(36.9%) patients had values ranging from 81-100 and 6 (4.9%) patients had values ranging from 60-80. Rochon et al. and Stanicka et al. have demonstrated that hypothyroidism can also lead to insulin resistance. [12,13]

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A higher degree of insulin resistance has also been described among patients with subclinical and overt hypothyroidism by Maratou et al. [14]

In our study population, 35(28.7%) patients had triglyceride values of 100-150, other 35(28.7%) had values of 151-200 and 52(42.6%) had triglyceride values >200. The Nord Trondelag Health (HUNT) study concluded that within the range of TSH that is considered clinically normal, an increasing level of TSH is associated with less favourable lipid concentrations. The association with serum lipids was linear across the entire reference range of TSH. [15]. Asvold et al. found a significant association between triglycerides and serum TSH in subjects 50 years and older. [16]

In a similar study done by Garcia et al, the metabolic syndrome group in the Hispanic population has shown a linear association of TSH with total cholesterol, LDL-C, and triglycerides. [17]

A one-unit increase in TSH was associated with an approximately 1% increase in triglyceride levels in a study conducted by Avantika et al. [18]

In the present study, 36(29.5%) had low HDL of <40, 45(36.9%) patients had HDL of 40-49, 34 (27.9%) patients had HDL of 50-59 and 7(5.7) patients had HDL of > 60. There is a negative relation between TSH and HDL cholesterol in a Chinese-based study by Yang et al.

In our study, 3(2.5%) had free T4 of >1.9, 94 patients (77%) belonged to the normal range of free T4, that is 0.8 to 1.9 and 57(46.7%) patients had elevated TSH values of >5, 39 (32%) had TSH values of 2.6-5 and 26(21.3%) have TSH values of <2.5%. A TSH value below 2.5 mU/l was proposed to be associated with a favorable metabolic profile. [19] One study of a euthyroid German cohort (mean age 52) found that TSH in the upper normal range (2.5–4.5 mIU/l) was associated with a 1 – 7 fold increased risk of MetS compared with a low-normal TSH (0.3–2.5 mIU/l). [20]

In our study, out of 122 patients, 43(35.2%) patients had subclinical hypothyroidism, 17 (13.9) had overt hypothyroidism, 3 (2.5%) were hyperthyroid and 59(48.4%) patients were euthyroid. Shantha et al's cross-sectional study in south India showed the association between metabolic syndrome and primary hypothyroidism in the urban population [21]. Study done by Uzunululu et al. also had shown a significant association between subclinical hypothyroidism and metabolic syndrome [22]. Subclinical hypothyroidism was found in 36 (16.4%) cases in the metabolic syndrome group and in 11 (5.8%) cases in the control group ($p = 0.001$).

Study in India by Agarwal et al. of the seventy-six patients with Met S., 78.0% had thyroid dysfunction with 53.0% to be subclinical hypothyroidism and 25.0% had overt hypothyroidism [23] A prospective cross-sectional study was conducted in the internal medicine department at El Okbi Hospital of Guelma (East of Algeria) from January 2014 to September 2015 and thyroid dysfunction was found in 59.3 % (n = 42) patients. Hypothyroidism (45.3%) was the major thyroid dysfunction followed by hyperthyroidism (14.0%).

There was no evidence of any relationship between thyroid status and all the components of metabolic syndrome. A study done by Ginnaram et al. also found no association between components of metabolic syndrome and thyroid dysfunction.

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Conclusion

Not all patients with metabolic syndrome have signs and symptoms suggestive of thyroid dysfunction. So, it is very difficult to exclude the diagnosis of thyroid dysfunction on clinical basis. Thyroid dysfunction, predominantly subclinical hypothyroidism has been observed more frequently in patients with metabolic syndrome than in the general population and it is much more prevalent in females than males. Although there was no evidence of any relationship between thyroid status and all the components of metabolic syndrome, thyroid dysfunction should be `considered when evaluating and treating patients with metabolic syndrome to reduce the impending risk.

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