Original Research Article

A study of thyroid dysfunction in metabolic syndrome patients in Chengalpattu District

Navin B[1], K.E. Arumugam[2*]

[1]Postgraduate Resident, [2]Professor
Department of General Medicine, Karpga Vinayaga Institute of Medical Sciences and Research, Maduranthagam, Chenngalpattu District, Chennai, Tamil Nadu, India
[*]Corresponding author email: **drarumugam.chemco@yahoo.co.in**

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Abstract

Background: The metabolic syndrome consists of central distribution of adiposity, insulin resistance, elevations in plasma free fatty acid levels, impaired glucose tolerance, hypertension, dyslipidemia, and an abnormal procoagulant state. Many features of this syndrome are known to predispose men and women to premature coronary artery disease. Subclinical hypothyroidism has also been suggested as a risk factor for atherosclerosis, hyperlipidemia, hypertension, low-grade inflammation and hypercoagulability. Thyroid functions affect metabolic syndrome parameters including high-density lipoprotein (HDL) cholesterol, triglycerides, blood pressure and plasma glucose. As metabolic syndrome and hypothyroidism are independent risk factors for the same disease process namely cardiovascular disease, it is possible that patients suffering from both these disease entities may have a compounded risk.

Aim and objective: Association of thyroid dysfunction and Metabolic syndrome and to find out the type of thyroid dysfunction in metabolic syndrome patients.

Materials and methods: A total of 60 patients admitted to the Department of General Medicine, Karpaga Vinayaga Institute of Medical Sciences and Research Centre, were included in this study. Sixty cases were defined according to the IDF criteria. A detailed history and necessary investigations like fasting blood samples were analyzed for total triiodothyronine (T3), total thyroxine (T4), thyroid-stimulating hormone (TSH), lipid profile, and blood glucose was undertaken.

Results: In our study, population of metabolic syndrome cases, the Thyroid dysfunction was present in 16.7% of patients. Among the thyroid dysfunction, subclinical hypothyroidism was highly prevalent – 11.7%. The hypothyroidism was 3.3% prevalent in metabolic syndrome patients (one patient had TSH levels of more than 150 mU/L) and subclinical hyperthyroidism was 1.7% prevalent. There were no overt hyperthyroidism patients in our study.

Conclusion: This study clearly showed that one-sixth of metabolic syndrome patients or every sixth metabolic syndrome patient had hypothyroidism either overt or subclinical. This finding indicates a need for investigating the presence of Thyroid dysfunction during managing metabolic syndrome patients.

Key words

Metabolic syndrome, Thyroid dysfunction, Dyslipidemia, Hyperglycemia.

Introduction

Metabolic Syndrome (MS) is defined as a "constellation" of cardiometabolic risk factors, which, jointly, increases the risk of suffering cardiovascular diseases and type 2 diabetes mellitus. However, its presence has been related to a great number of alterations that go from cancer to sleep apnea, polycystic ovary syndrome, thyroid disruptions, amongst others [1]. The high prevalence of MS is a worrying matter in various Latin American populations. On the other hand, subclinical hypothyroidism (Sch) is defined by high thyroid-stimulating hormone (TSH) levels with normal free thyroxine (T4) [2]. People with metabolic syndrome are at high risk for developing cardiovascular disease and are twice likely to die from and three times as likely to have a myocardial infarction, stroke compared with people without this syndrome. Insulin resistance is supposed to be the central pathophysiological phenomenon underlying the clustering [3]. Thyroid disease is associated with atherosclerotic cardiovascular disease. This association may be in part be explained by thyroid hormones regulation of lipid metabolism and its effects on blood pressure. Thyroid hormones have ubiquitous effects and influence the function of most organs [4]. This hormone appears to serve as a general pacemaker accelerating the metabolic process and may be associated with metabolic syndrome. Both metabolic syndrome and thyroid dysfunction are associated with an increased risk of atherosclerotic heart disease. Little is known about the relationship between metabolic syndrome and thyroid dysfunction [5]. Only a few small studies have been performed. In a cross-sectional study in 220 metabolic syndrome patients, it was found that subclinical hypothyroidism was prevalent in 16.4% of metabolic syndrome patients. Therefore, the association of thyroid dysfunction with metabolic syndrome was evaluated in this study [6].

Materials and methods

Sixty cases were defined according to the IDF criteria. A detailed history and necessary investigations like fasting blood samples were analyzed for total triiodothyronine (T3), total thyroxine (T4), thyroid-stimulating hormone (TSH), lipid profile, and blood glucose was undertaken. The patients who fulfilled the criteria for metabolic syndrome by IDF were taken into the study. For a person to be defined as having the metabolic syndrome they must have central obesity - defined as waist circumference with ethnicity-specific values (for south Asians: ≥90 cm for men and ≥80cm for women were used) and any two of the following: Raised triglycerides: > 150 mg/dL (1.7 mmol/L), or specific treatment for this lipid abnormality. Reduced HDL cholesterol: < 40 mg/dL in males, < 50 mg/dl in females, or specific treatment for lipid abnormality. Raised blood pressure: systolic BP > 130 or diastolic BP >85 mm Hg, or treatment of previously diagnosed hypertension. Raised fasting plasma glucose: (FPG)>100 mg/dl, or previously diagnosed type 2 diabetes mellitus.

Inclusion criteria: Patients of Age more than 18 years, who fulfilled the criteria for metabolic syndrome by International diabetic foundation (IDF) were taken into study. Patients with metabolic syndrome not on any medications – newly detected metabolic syndrome patients.

Exclusion criteria: Known hypothyroid or sub-clinical hypothyroid or hyperthyroidism patients,

Patients taking medications for diabetes mellitus, hypertension, thyroid disorders, dyslipidemia, Patients taking steroids, Individuals less than 18 years ago.

A detailed history of medication and anthropometric measurements like height, weight, waist circumference were noted in a semi-structured proforma. Blood pressure was recorded in the right upper limb in a sitting posture. After eight hours of fasting, blood was drawn for fasting blood sugar, lipid profile and thyroid assay in a single sitting. The fasting blood sugar was done by an enzymatic colorimetric method using a semi auto analyzer. The high-density lipoprotein cholesterol and triglycerides were done enzymatically on XL-300 ERBA fully automated clinical chemistry analyzer. The thyroid hormone assay (TSH, T3, and T4) was done by Chemiluminescence Immuno Assay (CLIA) using ADVIA Centaur equipment.

Statistical analysis

All patients in the two categories were analyzed by the Chi-square test and t-test for significance.

Results

Among the 60 patients included in our study, 27 patients were men accounting for 45% of the total cases. The remaining 33 patients were (55%) women. According to age, patients' between 30 and 39 years of age were 15 in number (25%). The majority of the patients were in the age group between 40 and 49 years - 28 patients (47% of the study population) were in this group. 11 patients (18%) were between the age of 50 and 59 years. 6 patients (10%) were above the age of 60. Population characteristics are shown in table 1. According to the metabolic syndrome parameters, 60 members included in the study, 19 fulfilled three among five metabolic syndrome parameters criteria. Another 19 members fulfilled four metabolic syndrome parameters criteria and the rest of 22 members fulfilled all the metabolic syndrome criteria (**Table – 1**).

The thyroid dysfunction was 16.7% prevalent in metabolic syndrome patients. Among the thyroid dysfunction, subclinical hypothyroidism was highly prevalent – 11.7%. The hypothyroidism was 3.3% prevalent in metabolic syndrome patients (one patient had TSH levels of more than 150 mU/L) and subclinical hyperthyroidism is 1.7% prevalent. There were no overt hyperthyroidism patients in our study (**Table – 2**).

According to the age, patients age between 30 and 39 years were 15 in number, among them one patient had frank hypothyroidism and one patient had subclinical hypothyroidism. In the 40-49 age group, 4 patients had subclinical hypothyroidism and one patient had subclinical hyperthyroidism. In the 50-59 years age group, one patient had frank hypothyroidism and two patients had subclinical hypothyroidism. In the above the age of 60, all 6 patients were normal (**Table – 3**).

Table – 1: Population characteristics.

Age (Years)	Total no.	Percentage	Male	Female
30-39	15	25%	6	9
40-49	28	47%	14	14
50-59	11	18%	1	10
60-69	6	10%	6	0

Based on the metabolic syndrome criteria, of those patients who fulfilled three of the five risk factors three had thyroid dysfunction; of the patients who had four risk factors two had thyroid dysfunction; of the patients who had all five risk factors five had thyroid dysfunction (**Table – 4**). As there were a considerable number of patients only in the euthyroid group (50) and sub-clinical hypothyroid group (7), both groups were analyzed statistically using the student t-test. But

these analyses were not statistically significant, as they were very small no of individuals in both subgroups and variants are very high in both subgroups. Correlation between the T4, TSH, and metabolic parameters was also analyzed (P valve = 0.36 not significant) as per **Table - 5**.

Table – 2: Thyroid dysfunction.

Group	Total no.	%	Male	Female
Euthyroid	50	83.33 %	26	24
Hypothyroid	2	3.33 %	1	1
Subclinical Hypothyroidism	7	11.67%	0	7
Subclinical Hyperthyroidism	1	1.67%	0	1
Hyperthyroidism	0	0	0	0

Table – 3: Age wise thyroid dysfunction.

Age (Years)	Total No	Euthyroid	Hypo Thyroid	Subclinical Hypothyroid	Subclinical Hyperthyroid
30-39	15	13	1	1	0
40-49	28	23	0	4	1
50-59	11	8	1	2	0
60-69	6	6	0	0	0

Table – 4: Metabolic syndrome parameters wise thyroid dysfunction.

MS criteria Fulfilled	Total no	Euthyroid	Hypo thyroid	Subclinical hypothyroid	Subclinical hyperthyroid
3	19	16	1	2	0
4	19	17	0	1	1
5	22	17	1	4	0

Table – 5: Distribution of thyroid dysfunction.

MS parameters	Euthyroid		Sub clinical hypothyroidism		P-Value
	Mean	SD	Mean	SD	
WC	97.16	6.98	98.57	8.32	0.626
SBP	139.88	14.14	140.29	14.40	0.944
DBP	89.52	7.28	88.29	9.20	0.689
FBS	158.28	51.04	141.43	37.82	0.405
HDL	43.46	6.25	43.43	4.58	0.990
TGL	234.20	170.18	185.57	93.75	0.434

Table – 6: Correlation between T4, TSH and metabolic syndrome parameters in subclinical hypothyroid patients.

MS parameter	T4	P Value	TSH	P Value
WC	6.5	0.11	-0.577	0.17
SBP	5.14	0.23	-0.511	0.24
DBP	-4.9	0.91	0.060	0.89
FBS	7.41	0.05	-0.576	0.17
HDL	4.6	0.29	-0.249	0.58
TGL	-4.04	0.82	-0.134	0.77

As there were small no of patients with very high variants, statistically significant results were not found (P valve > 0.05 not significant at 5% level) as per **Table – 5**.

Correlation coefficient values between T4, TSH, and metabolic parameters are not significant in our study, because of a limited number of study subjects and variants are high (P valve > 0.05 not significant at 5% level) as per **Table – 6**.

Discussion

The metabolic syndrome is a cluster of metabolic abnormalities wherein people are obese and have hypertension, high triglyceride level, low high-density lipoprotein cholesterol and abnormal fasting glucose levels. People with metabolic syndrome are at high risk of developing cardiovascular disease and type 2 diabetes. Hypothyroidism is associated with lipid abnormalities like high triglycerides and low high-density lipoproteins, weight gain, glucose intolerance, and hypertension. Thus hypothyroidism mimics the parameters of metabolic syndrome [7]. In this study, thyroid dysfunction is 16.7% among metabolic syndrome patients. Hypothyroidism is 15% prevalent in metabolic syndrome patients (Overt Hypothyroidism 3.3% and subclinical hypothyroidism 11.7%). The Association of thyroid dysfunction and hypothyroidism in metabolic syndrome patients are higher than in the normal population, which is 5.9% for thyroid dysfunction and 4.6% for hypothyroidism (0.3% overt and 4.3% subclinical hypothyroidism) [8]. This study is consistent with the study done by Lin SY, et al. as 16.4% of metabolic syndrome patients had hypothyroidism. In this study, subclinical hypothyroidism is highly prevalent – 11.7%. The reason maybe we are getting TFT done in all metabolic syndrome patients now. The hypothyroidism is 3.3% prevalent in metabolic syndrome patients (one patient had TSH levels of more than 150mU/L) and subclinical hyperthyroidism is 1.7% prevalent. There were no overt hyperthyroidism patients in our study [9]. In this study one-sixth of metabolic syndrome patients or every sixth patient with metabolic syndrome has hypothyroidism. It is well known and proven that, by treating with levothyroxine replacement in all overt or clinical hypothyroid patients, we can reduce all the metabolic parameters and cardiovascular risk. There is some controversy in treating subclinical hypothyroidism patients [10]. Managements of patients subclinical hypothyroidism remain controversial because the body of scientific evidence available to guide clinical decision is limited. The risk of progression from subclinical hypothyroidism to overt hypothyroid is 2-5% per year [11]. A meta-analysis report shows that levothyroxine therapy in individuals with subclinical hypothyroidism lowers mean serum total and low-density cholesterol concentration significantly and the reduction in serum cholesterol may be larger in individuals with higher pretreatment cholesterol levels [12]. Another double-blind placebo-controlled trial (Basal Thyroid Study) shows that an important risk reduction of cardiovascular mortality of 9 – 31% possible by the improvement in low-density lipoprotein cholesterol in subclinical hypothyroidism patients treated with levothyroxine therapy [13]. Cook S, et al. recommends treating subclinical hypothyroidism associated with type 2 diabetes and hypertension in his scientific review. As the metabolic syndrome patients have hyperlipidemia, diabetes, hypertension, and increased cardiovascular risk, it looks logical to treat metabolic syndrome patients having subclinical hypothyroidism by levothyroxine replacement therapy [14]. One-sixth of metabolic syndrome patients or every sixth metabolic syndrome had hypothyroidism either overt or subclinical. This finding indicates a need for investigating the presence of Thyroid dysfunction during managing metabolic syndrome patients. As shown in previous evidence, managing these hypothyroid in metabolic syndrome patients is rewarding by improvement in the metabolic parameters and reducing cardiovascular risk [15].

Conclusion

Thyroid dysfunction is common in metabolic syndrome patients and it occurred in 16.7% of metabolic syndrome patients in our study. Subclinical hypothyroidism is present in 11.7% and overt hypothyroidism is 3.3% in metabolic syndrome patients in our study. One-sixth of metabolic syndrome patients or every sixth metabolic syndrome had hypothyroidism either overt or subclinical. It is better to exclude the presence of Thyroid dysfunction while managing metabolic syndrome patients, for a better outcome.

References

1. Reaven GM. Banting Lecture 1988. Role of insulin resistance in human disease. Diabetes, 1988; 37: 1595-607.
2. Reaven GM, et al. Insulin resistance, cardiovascular disease and metabolic syndrome. Diabetes care, 2004; 27: 1011-12.
3. Grundy GM, et al. Obesity, metabolic syndrome and cardiovascular diseases. Jclin endocrinal metab., 2004; 89: 2595-2600.
4. Zimmet PZ, et al. The metabolic syndrome. Lancet, 2005; 365: 1415-1428.
5. Klein I, et al. Thyroid hormones and cardiovascular system. N Engl J med., 1976; 344: 501-509.
6. Duntas LH. Thyroid disease and lipids. Thyroid, 2002; 12: 287-293.
7. Uzunlulu M, Yorulmaz E, Oguz A. Prevalence of subclinical hypothyroidism in patients with metabolic syndrome. Endocr J, 2007; 54: 71-76.
8. Chandral, et al. Association metabolic syndrome and its components in thyroid dysfunction in females. Int J Diab Dev Ctries, March 2007; 27(1).
9. Lin SY, et al. Lower serum free thyroxine levels are associated with metabolic syndrome in the Chinese population. Metabolism, 2005; 54: 1524-8.
10. Ford ES. Prevalence of metabolic syndrome in the US population. Endocrinal Metabclin N Am., 2004; 33: 333-50.
11. Alberti KG, et al. Diagnosis and definition-provisional report of WHO consultation. Diabetes Med., 1998; 15: 539-553.
12. Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol In Adults 2001 Executive Summary of The Third Report of The National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, And Treatment of High Blood Cholesterol In Adults (ATP III). JAMA, 2001; 285: 2486–2497.
13. Bolkan B, et al. European group for the study of insulin resistance (EUIR). Diabet Med., 1999; 16: 442-443.
14. Cook S, et al. Prevalence of metabolic syndrome phenotype in adolescents: findings from the third national health and nutritional examination survey. Arch Pediatr Adolesc Med., 2003; 157: 821-7.
15. Yong-woo Park, et al. Prevalence and associated risk factor findings in the US population from the Third National Health and nutrition examination Survey,1988-1994. Arch Intern Med., 2003; 163: 427-436.