Original Research Article

Association between metabolic syndrome and thyroid stimulating hormone - A cross sectional study

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Abstract

Background: Thyroid dysfunction especially hypothyroidism and Metabolic Syndrome (MeS) are two entities which affect blood pressure, fasting plasma glucose, serum triglycerides and HDL-Cholesterol. Both are associated with increased chance of cardiovascular disease. **Methodology:** This was a cross sectional study done among 98 patients with metabolic syndrome in a tertiary care hospital in South India with an aim to find prevalence of hypothyroidism and its association with components of metabolic syndrome. **Results:** Majority 92(92.9%) were females in our study. 89.2% had history of Diabetes Mellitus (DM) and 62.2% had history of Hypertension (HTN). Among the subjects 39(40%) had subclinical hypothyroid state and 11(11%) had overt hypothyroidism. In our study we found that thyroid dysfunction that is hypothyroidism is significantly present in middle aged people (40-49 years), over weight patients and female gender. In our study we found that mean Waist circumference, diastolic BP and fasting blood glucose were more among thyroid dysfunction group compared to that of Euthyroid state **Conclusion:** Thyroid dysfunction particularly hypothyroidism is associated with metabolic syndrome and has to be seriously viewed as a threat in long term.
Key Word: Hypothyroidism, Metabolic Syndrome, Thyroid Stimulating Hormone, Cardiovascular disorders

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INTRODUCTION

Metabolic syndrome (MeS) – A complex mechanism of insulin resistance (IR) and compensatory release of more insulin leading to constellation of obesity (particularly central adiposity), hyperglycaemia, elevated blood pressure, dyslipidaemias (hypertriglyceridemia, decreased High Density-Lipoprotein Cholesterol (HDL-C) and increased Low Density Lipoprotein cholesterol (HDL-C)), and multiple pro-inflammatory conditions.(1-3) The prevalence of metabolic syndrome is increasing worldwide with an 2.5-fold increase in cardiovascular mortality and a 5-fold higher risk of developing diabetes.[2,4,5,6] It is also associated with increased risk of kidney disease and mortality due to all causes.[7] Subclinical hypothyroidism is an asymptomatic condition with high serum thyroid stimulating hormone (TSH) and normal free thyroid hormone levels. It is a prevalent condition among adult population which is frequently overlooked. Subclinical hypothyroidism has also been suggested as a risk factor for atherosclerosis, hyperlipidaemia, hypertension, low grade inflammation *and* hypercoagulability.[8] Thyroid dysfunction especially hypothyroidism is associated with all parameters of metabolic syndrome except increase in fasting blood glucose.[9] More than 60% of hypothyroid patients have obesity; there is decrease in basal metabolic rate and

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energy metabolism.[10] In hypothyroidism, the hemodynamic alterations cause narrowing of pulse pressure, prolongation of circulatory time and decrease in blood flow to the tissues leading to increased systemic vascular resistance and hypertension.[11,12] Both the synthesis and degradation of lipids are affected in hypothyroidism and the activity of cholesterol ester transfer protein is decreased thus HDL cholesterol level is reduced.[13] 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. Hence this study was conducted to explore the association between thyroid dysfunction *and* components of metabolic syndrome.

OBJECTIVES

1. To study the prevalence of hypothyroidism among metabolic syndrome patients attending a tertiary care hospital.
2. To know the association of hypothyroidism and components of metabolic syndrome among patients attending a tertiary care hospital.

METHODOLOGY

This was a cross sectional study done among 98 patients with metabolic syndrome in a tertiary care hospital in South India. All the patients were interviewed and physical examination was done. Informed consent was obtained from all the participants prior to start the study. Blood pressure (BP) was measured using an automated sphygmomanometer, with the patient in the sitting position before the blood test. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2) and BMI >25 kg/m^2 was considered as overweight and >30 kg/m^2 as obese. Waist circumference (WC) was measured with the measuring tape positioned midway between the lowest rib and the superior border of the iliac crest while the patient exhaled normally. The blood sample was collected in the morning after an 8–12-hour fast. Levels of glucose, Total cholesterol (TC), High density lipoprotein cholesterol (HDL-C), Low-density lipoprotein cholesterol (LDL-C), and Triglyceride (TG), Very Low-density lipoprotein cholesterol (VLDL-C), were determined in the hospital laboratory using standard methods. The components that contribute to metabolic syndrome were defined as high BP (≥ 130/85 mmHg), Ttruncal obesity (WC > 90 cm for men, > 80 cm for women), Hypertriglyceridemia (>150mg/dL or 1.7mmol/L), Low HDL-C (<40mg/ dL or 1.0mmol/L for men, < 50mg/ dL or 1.3mmol/L for women) and Hyperglycaemia (fasting blood glucose level ≥ 110 mg/ dL or 6.1 mmol/L).[14,15] Thyroid stimulating hormone (TSH) was estimated by the electro-chemiluminescence immune assay (ECLIA). Normal range for TSH was 0.27–4.2 µIU/ml. A high serum TSH level (4.2–10 µIU/ml) was required for the diagnosis of subclinical hypothyroidism. Patients with high TSH (>10 µIU/ml) was classified as being overt or clinical hypothyroid. Patients with normal TSH, T3, and T4 were considered euthyroid.[16] Demographic data was summarised descriptively. Continuous variables were expressed as mean ± standard deviation. Categorical variables were presented as percentages.

RESULTS

A total of 98 subjects were included in the study with mean (SD) age of 50.09 (10.14) years. Among the 98 subjects, 30(30.6%) belonged to the age group of 40 to 49 years. Majority 92 (93.9 %) were females in the study. Among the subjects 88(89.8%) had history of Diabetes Mellitus (DM) and 61 (62.2%) had history of Hypertension (HTN). Majority 75(76.5%) were overweight with a Body Mass Index (BMI) between 25-29.9 kg/m^2. The mean (SD) BMI was 27.96(2.23) with a minimum of 23 and maximum of 35 kg/m^2.

Table 1: Descriptive statistics of variables among the study population

Variable	Category	Frequency (%)
Age(years)	<40	21(21.4%)
	40-49	30(30.6%)
	50-59	19(19.4%)
	>60	28(28.6%)
Gender	Male	6(6.1%)
	Female	92(93.9%)
Presence of Diabetes Mellitus	Yes	88(89.8%)
	No	10(10.2%)
Presence of Hypertension	Yes	61(62.2%)
	No	37(37.8%)
Body Mass Index (Kg/m^2)	Normal (18.5-24.9)	4(4.1%)
	Overweight(25-29.9)	75(76.5%)
	Obese(>30)	19(19.4%)

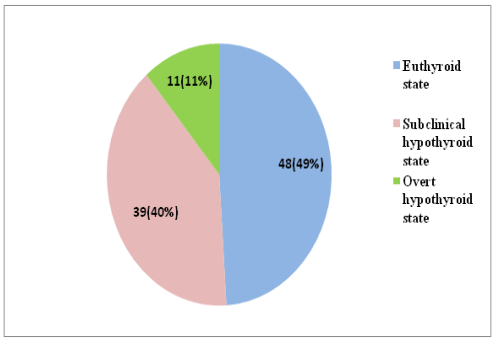

Figure 1: Thyroid status among the study population

Among the subjects 39(40%) had subclinical hypothyroid state and 11(11%) had overt hypothyroidism. Mean TSH

level was 6.89±7.67 µIU/ml with a minimum of 1.00 and maximum of 55 µIU/ml. In our study we found that thyroid dysfunction that is hypothyroidism is significantly present in middle aged people (40-49 years), over weight patients and female gender. Thyroid dysfunction was present more in hypertensives and diabetics. But the association is not statistically significant. (Table2). In our study we found that mean Waist circumference, diastolic BP and fasting blood glucose were more among thyroid dysfunction group compared to that of Euthyroid state. (table 3)

Table 2: Association between TSH levels and different variables

Variable	Category	Euthyroid state	Thyroid dysfunction	Chi square value	p value
Age (years)	<40	11(52.4%)	10(47.6%)	17.01	0.001[a]*
	40-49	8(26.7%)	22(73.3%)		
	50-59	7(36.8%)	12(63.2%)		
	>60	22(78.6%)	6(21.4%)		
BMI (Kg/ m²)	18.5-24.9	4(100%)	0	22.32	<0.001[b]*
	25-29.9	43(57.3%)	32(42.7%)		
	>30	1(5.3%)	18(94.7%)		
Gender	Male	6(100%)	0	7.50	0.006[b]*
	Female	42(45.65 %)	50(54.35%)		
HTN	Yes	32(52.46 %)	29(47.54%)	1.83	0.32[b]
	No	16(43.2%)	21(56.8%)		
DM	Yes	44(50%)	44(50%)	1.32	0.42[b]
	No	4(40%)	6(60%)		

* p value,0.05 is significant a- chi-square test, b- Fischer's exact test

Table 3: Components of metabolic syndrome among Euthyroid and thyroid dysfunction group

Parameters	Euthyroid state	Thyroid dysfuction
Systolic BP(mmHg)	145.17 ±9.41	140.72±2.01
Diastolic BP(mm Hg)	89.17±8.23	91.44±5.69
Waist Circumference(cm)	100.58±8.55	109.48±8.81
Triglyceride(mg/dl)	180.71±16.90	180.70±18.87
Fasting blood glucose(mg/dl)	148.15±27.29	156.22±28.69
HDL cholesterol(mg/dl)	37.19±9.25	36.40±4.45

DISCUSSION

In our study we aimed to identify thyroid dysfunction patients particularly hypothyroid among metabolic syndrome patients attending tertiary care hospital. Metabolic syndrome by itself is related to may endocrine and non endocrine disease and can predict the development of those diseases. In our study among the subjects 39(40%) had subclinical hypothyroid state and 11(11%) had overt hypothyroidism. This finding is similar to many studies.[17,19] In a study[17] among metabolic syndrome patients in Nepal identified thyroid dysfunction as a common endocrine disorder in metabolic syndrome patients; subclinical hypothyroidism (26.6 %) was the commonest followed by overt hypothyroidism (3.5 %) and subclinical hyperthyroidism (1.7 %). In our study we found that thyroid dysfunction that is hypothyroidism is significantly present in middle aged people (40-49 years), over weight patients and female gender. The mean age of our study population was 50.09±10.14 years. Similar mean age and peak incidence among >40 years is found in many studies.[20,21] Increased BMI and thyroid dysfunction is a common feature which is demonstrated in many studies.[22,23] As previously demonstrated overweight and obesity can accelerate the development of endocrine disorders. In our study we found that mean Waist circumference, diastolic BP and fasting blood glucose were more among thyroid dysfunction group compared to that of Euthyroid state. The link between waist circumference and thyroid dysfunction was demonstrated by other studies[19,20] also. Increased waist circumference denotes abdominal obesity which eventually leads to many endocrine disorders. Demonstration of raised diastolic BP among thyroid dysfunction patients denotes a increased probability of cardiovascular disorders. It has been reported that 95 % of newly diagnosed hypothyroid patients have increased levels of cholesterol and 5 % of have hyper triglyceridemia. Hypothyroidism also leads to increased level of LDL cholesterol. All these factors directly contribute to accelerated atherosclerosis.[24] Positive association of metabolic syndrome and thyroid dysfunction is demonstrated by many studies[17,18,20] whereas one study[25] particularly rejects the link between the two.

CONCLUSION

In our study we found that majority of metabolic syndrome patients had hypothyroidism. Also we found that thyroid dysfunction that is hypothyroidism is significantly present in middle aged people (40-49 years), over weight patients and female gender. High prevalence of overt and subclinical hypothyroidism in metabolic syndrome as seen in our study may have harmful effect on cardiovascular health. Hypothyroidism will lead to increased lipid levels and hypertension leading to increased risk for CVD. Our study lacks the presence of a control group to get a better view about the presence of hypothyroid state in metabolic syndrome patients. Also inclusion of dietary and exercise factors would have added up more value.

REFERENCES

1. Alberti KG, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JI, Donato KA, Fruchart JC, James WP, Loria CM, Smith Jr SC. Harmonizing the metabolic syndrome: a joint interim statement of the international diabetes federation task force on epidemiology and prevention; national heart, lung, and blood institute; American heart association; world heart federation; international atherosclerosis society; and international association for the study of obesity. Circulation. 2009 Oct 20; 120(16):1640-5.
2. Pandey S, Baral N, Majhi S, Acharya P, Karki P, Shrestha S, et al. Prevalence of the metabolic syndrome in acute myocardial infarction and its impact on hospital outcomes. Int J Diab Dev Ctries. 2009; 29(2):52-5.
3. Dhanraj E, Bhansali A, Jaggi S, Dutta P, Jain S, Tiwari P. Prevalence and predictors of metabolic syndrome in nonobese Asian Indians with newly detected type 2 diabetes mellitus. J Ind Med Assoc 2008; 106: 366-72.
4. Moreira GC, Cipullo JP, Ciorlia LA, Cesarino CB, Vilela-Martin JF. Prevalence of metabolic syndrome: association with risk factors and cardiovascular complications in an urban population. PloS one. 2014 Sep 2; 9(9):e105056.
5. M. A. Cornier, D. Dabelea, T. L. Hernandez et al., "The metabolic syndrome," Endocrine Reviews, vol. 29, no. 7, pp. 777–822, 2008
6. P. A. Sarafidis and P. M. Nilsson, "The metabolic syndrome: a glance at its history," Journal of Hypertension, vol. 24, no. 4, pp. 621–626, 2006.
7. J. Chen, P. Muntner, L. L. Hamm et al., "The Metabolic Syndrome and Chronic Kidney Disease in U.S. Adults," *Annals of Internal Medicine*, vol. 140, no. 3, pp. 167–I39, 2004.
8. Fauci AS, Braunwald E, Kasper DL, Hauser SL, Longo DL, Jameson JL, et al. Harrison'sPrinciples of Internal Medicine. 18th ed. USA: McGraw-Hill; 2012.
9. Melmed S, Polonsky KS, Larsen PR, Kronenberg HM, et al. Williams textbook of endocrinology.12th ed. USA; Elsevier:2011.
10. Zulewski H, Müller B, Exer P, Miserez AR, Staub JJ. Estimation of tissue hypothyroidism by a new clinical score: evaluation of patients with various grades of hypothyroidism and controls. The Journal of Clinical Endocrinology *and* Metabolism. 1997 Mar 1;82(3):771-6.
11. Klein I, Ojamaa K. Thyroid hormone and the cardiovascular system. New England Journal of Medicine. 2001 Feb 15;344(7):501-9.
12. Polikar R, Burger AG, Scherrer U, Nicod P. The thyroid and the heart. Circulation. 1993 May 1; 87(5):1435-41.
13. Kc R, Khatiwada S, Deo Mehta K, Pandey P, Lamsal M, Majhi S. Cardiovascular Risk Factors in Subclinical Hypothyroidism: A Case Control Study in Nepalese Population. J Thyroid Res. 2015; 2015: 305241.
14. Alberti KGMM, Zimmet P, Shaw J. Metabolic syndrome: a new world-wide definition. A consensus statement from the International Diabetes Federation. Diabetes Med 2006; 23: 469–80.
15. Tan CE, Ma S, Wai D, Chew SK, Tai ES. Can we apply the National Cholesterol Education Program Adult Treatment Panel definition of the metabolic syndrome to Asians? Diabetes Care 2004; 27: 1182–6.
16. Bahn Chair RS, Burch HB, Cooper DS, Garber JR, Greenlee MC, Klein I, et al. Hyperthyroidism and other causes of thyrotoxicosis: management guidelines of the American Thyroid Association and American Association of Clinical Endocrinologists. Thyroid. 2011; 21(6):593-646.
17. Khatiwada S, Sah SK, Rajendra KC, Baral N, Lamsal M. Thyroid dysfunction in metabolic syndrome patients and its relationship with components of metabolic syndrome. Clinical diabetes and endocrinology. 2016 Dec; 2(1):3.
18. Gyawali P, Takanche JS, Shrestha RK, Bhattarai P, Khanal K, Risal P, Koju R. Pattern of thyroid dysfunction in patients with metabolic syndrome and its relationship with components of metabolic syndrome. Diabetes *and* metabolism journal. 2015 Feb 1; 39(1):66-73.
19. Khatiwada S, KC R, Sah SK, Khan SA, Chaudhari RK, Baral N, Lamsal M. Thyroid dysfunction and associated risk factors among nepalese diabetes mellitus patients. International journal of endocrinology. 2015; 2015.
20. Saluja M, Pyarsabadi P, Jelia S, Chittora S, Swami Y, Vimlani H. Study of thyroid dysfunction in metabolic syndrome and association with its components. Current Medicine Research and Practice. 2018 Jan 1; 8(1):3-7.
21. Agarwal G, Sudhakar MK, Singh M, Senthil N, Rajendran A. The prevalence of thyroid dysfunction among south Indian women with metabolic syndrome. J Clin Diagn Res. 2011 Apr; 5(2):213-6.
22. Reinehr T. Thyroid function in the nutritionally obese child and adolescent. Current opinion in pediatrics. 2011 Aug 1; 23(4):415-20.
23. Pearce EN. Thyroid hormone and obesity. Curr Opin Endocrinol Diabetes Obes. 2012; 19: 408–413.
24. Gluvic Z, Sudar E, Tica J, Jovanovic A, Zafirovic S, Tomasevic R, Isenovic ER. Effects of levothyroxine replacement therapy on parameters of metabolic syndrome and atherosclerosis in hypothyroid patients: a prospective pilot study. International journal of endocrinology. 2015; 2015.
25. Tarcin O, Abanonu GB, Yazici D, Tarcin O. Association of metabolic syndrome parameters with TT3 and FT3/FT4 ratio in obese Turkish population. Metabolic syndrome and related disorders. 2012 Apr 1; 10(2):137-42.

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