

A Study on “Correlation of Thyroid Profile with the Components of Metabolic Syndrome”

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Abstract

Introduction: As there is an exponential rise in the prevalence of metabolic syndrome (MetS) in pandemic proportions as well as a steady increase in incidence of subclinical hypothyroidism (SCH),

Material and Methods: A cross-sectional study of association between these two entities is been carried. Authors studied thyroid function tests in 100 cases of MetS and 50 controls.

Results: The results were analyzed and we found that the prevalence of SCH in MetS was found to be 21% when compared to only 6% in the control population. This association with SCH is more frequent among women. The thyroid dysfunction in MetS is statistically significantly associated with the serum triglycerides, followed closely by the waist circumference. This association is not found with the other components of MetS.

Conclusion: Due to the alarming rise, in CV mortality and morbidity, the people at risk have to be identified at the earliest and their risk factors modified. Hence, diagnosing MetS should become a routine practice among the medical fraternity.

Key words: Sub clinical hypothyroidism, Metabolic syndrome, Pro inflammatory state

INTRODUCTION

Need for the Study

Metabolic syndrome (MetS) has affected >25% of the population in the western civilizations. MetS is a major determining factor for the early onset of insulin-resistant diabetes and accelerated atherosclerosis. MetS is clinically a conglomeration of risk factors highlighted by the presence of systemic hypertension, altered lipid profile, dysglycemia, pro-inflammatory, and prothrombotic states.

Subclinical hypothyroidism (SCH) and MetS are well-established risk factors for atheromatous-occlusive vascular diseases, dyslipidemia, low-grade persistent inflammatory state, and procoagulable state. This association may be in part be explained by thyroid hormone's regulatory effect on lipid metabolism and blood pressure.

MetS and subclinical/overt thyroid dysfunction are independent risk factors, in the genesis of cardiovascular diseases. Hence, it is plausible that persons affected with both these conditions could have more than additive hazard.

This study is a step toward ascertaining the possible positive link of thyroid dysfunction with the components of MetS.

International Diabetic Foundation (IDF) Definition

For a person to be diagnosed to have MetS, he/she should have, the following essential criteria.

Central obesity defined as waist circumference (WC) with ethnic specificity, >90 cm for Asian men and >80 cm for Asian women.

Plus any two of the following criteria:

Raised triglycerides

- >150 mg/Dl (1.7 mmol/L)
- (or) On specific treatment for this lipid abnormality

Reduced high-density lipoprotein (HDL) cholesterol

- <40 mg/Dl (1.03 mmol/L) in males

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- <50 mg/dl (1.29 mmol/L) in females
- (or) On specific treatment for this lipid abnormality

Raised blood pressure

- Systolic blood pressure (SBP) 130 mmHg and above
- (or) Diastolic blood pressure (DBP) 85 mmHg and above
- (or) On treatment of previously diagnosed hypertension

Raised fasting blood sugar (FBS)

The FPG >100 mg/dl (5.6 mmol/L), if above 5.6 mmol/L or 100 mg/dl, OGTT is strongly recommended but is not necessary to define the presence of the syndrome.

SCH

Definition

SCH is defined as a serum thyroid-stimulating hormone (TSH) level above the upper limit of normal despite normal levels of serum free thyroxine. TSH levels 5.5–10.0 Mu/l correspond to the prevalence of SCH.

The incidence of SCH ranges from 6% to 8%, based on the sex, age, and ethnicity of the subjects studied. The effects of SCH depend on the duration and the degree of thyroid dysfunction as measured by TSH.

Objectives of the Study

The objectives of this study were as follows:

- To find out the type of thyroid dysfunction in MetS.
- To find out the association of thyroid dysfunction with the components of MetS.

MATERIALS AND METHODS

Source of Data

Patients attending outpatient department of the Department of Internal Medicine, Tirunelveli Medical College Hospital, who are being diagnosed as MetS and fulfill inclusion and exclusion criteria.

METHOD OF COLLECTION OF DATA

Sample Size

The sample size was 100 subjects with MetS and 50 controls.

Sampling method

This was a simple random sampling method.

Inclusion Criteria

Patients fulfilling the criteria for MetS by IDF were taken into study.

Patients with MetS not on any medications - newly detected MetS patients.

Exclusion Criteria

The following criteria were excluded from the study:

- Known patients of hypothyroid or subclinical hypothyroid or hyperthyroidism.
- Patients on medications for diabetes mellitus, hypertension, thyroid disorders, and dyslipidemia.
- Patients on steroids.
- Acutely ill patients.
- Individuals <18 years age, who cannot give consent.

Method of Study

The purpose of the study was explained to the patient and informed consent was obtained. Data were collected using a pretested pro forma meeting the objectives of the study. Detailed history and necessary investigations were undertaken. Patients were selected for the study who satisfied all the inclusion and exclusion criteria. Patients were diagnosed having MetS by the following criteria.

IDF criteria

All the patients enrolled for the study were subjected to thyroid function test. Test results were entered into an Excel sheet. Meticulous analysis of the data was carried out.

RESULTS AND OBSERVATION

Statistical Method

All the compiled data were analyzed using computer-based software. By Chi-square test, *P*-value was calculated. *P* < 0.05 was considered as statistically significant.

Age Distribution among the Subjects

The mean age of the MetS subjects was around 36 years. The mean age of the controls was found to be 34.7 years. This difference had no statistical significance. This implied that the subjects and the controls were comparable, with respect to their age. Thus, the impact of age, on the incidence of SCH, was negated, in the study population.

As clearly seen from the chart, more than two-thirds of the subjects fall in the 30–40 years age category. Clustering of MetS in the 30–40 years age group reveals the deleterious effects of the wrong lifestyle patterns in the past two decades.

Sex Distribution of MetS Subjects

Of the 100 MetS subjects, 39 were male and 61 were female. This is consistent with the results of many observational studies, which found out that the incidence of MetS is 1.5–2 times higher in females compared to males.

P < 0.05, this means, the sex difference noted in the prevalence of MetS is statistically significant.

The female sex, supposed to have protective effect against, CV diseases, is the easy target for MetS. This strong clustering of CV risk factors negates the natural protection for women, against cardiovascular diseases.

Prevalence of SCH in MetS

Of the 100 MetS subjects, 21% had SCH. Of the 50 controls, only three had SCH, which means the prevalence among the control population is around 6% only.

Both SCH and MetS, individually being CV risk factors, their combination more than doubles the risk.

Sex-Wise Prevalence of SCH

More than 80% of the patients having the double jeopardy of MetS with SCH, were women. Out of the 21 patients having both MetS and SCH, 17 were women, whereas only 4 were men.

Body Mass Index (BMI)-Wise Distribution of Thyroid Function

As expected, BMI was significantly higher in MetS, compared to the controls. However, the difference was not significant, among MetS with SCH and MetS with euthyroid status. $P > 0.05$ implying no statistical significance.

This reiterates the “thin fat Asian phenotype” concept. BMI is not an ideal marker, in Asian population when compared to their European counterparts.

Visceral adiposity is the determining factor in the definition of MetS.

Comparing Thyroid Function with MetS Components

WC	Men WC (cm)	Women WC (cm)
MetS with SCH	100.3	93.6
MetS with euthyroid	95.5	87.5

WC: Waist circumference, MetS: Metabolic syndrome, SCH: Subclinical hypothyroidism

WC is the essential criteria for diagnosing MetS. Both men and women with MetS have higher WC compared to their euthyroid counter-parts. However, this difference is subtle, with $P > 0.05$ statistically insignificant.

WC is the indirect measure of visceral adiposity. This has been also found to be associated with the incidence of fatty liver and non-alcoholic fatty liver disease.

Thyroid function	Men FBS (mgs%)	Women FBS (mgs%)
MetS with SCH	101	99.5
MetS with euthyroid	95.5	98.7

FBS: Fasting blood sugar, MetS: Metabolic syndrome, SCH: Subclinical hypothyroidism

FBS, among MetS, was in the range of 88–115 mgs%, with the average value being 97.7 mgs%. Of the 18 women with both MetS and SCH, eight had an FBS value >100

mgs%. Of the 3 men with both MetS and SCH, two had an FBS value >100 mgs%. However, this difference in FBS is insignificant.

Thyroid function	Men TGL (mgs%)	Women TGL (mgs%)
MetS with SCH	182.3	182.2
MetS with euthyroid	139.5	141.2

MetS: Metabolic syndrome, SCH: Subclinical hypothyroidism

Fasting triglycerides, among MetS, were in the range of 112–230 mgs%, with the average value being 148.7 mgs%. Of the 18 women with both MetS and SCH, all 18 had a TGL value >150 mgs%. Of the 3 men with both MetS and SCH, all three had a TGL value >150 mgs%.

This strongly implies that raised TGL is an integral aspect of patients with both MetS and SCH. P value is < 0.05 . Hence raised TGL value, >150 mgs%, in MetS should arise suspicion to screen for thyroid dysfunction.

Thyroid function	Men HDL (mgs%)	Women HDL (mgs%)
MetS with SCH	37	45.6
MetS with euthyroid	36.2	46.5

MetS: Metabolic syndrome, HDL: High-density lipoprotein, SCH: Subclinical hypothyroidism

Of the 18 women with both MetS and SCH, 14 had an HDL value <50 mgs%. Of the three men with both MetS and SCH, two had an HDL value >40 mgs%.

When compared to their euthyroid counterparts, both men and women with MetS and SCH had similar HDL values. This rule out HDL is a definite marker to screen for thyroid dysfunction among MetS subjects.

Thyroid function	Men SBP (mmHg)	Women SBP (mmHg)
MetS with SCH	132.7	129.9
MetS with euthyroid	136.6	131.4

MetS: Metabolic syndrome, SBP: Systolic blood pressure, SCH: Subclinical hypothyroidism

Of the 18 women with both MetS and SCH, seven had an SBP value >130 mmHg. Of the three men with both MetS and SCH, one had SBP value >130 mmHg.

When compared to their euthyroid counterparts, both men and women with MetS and SCH had similar SBP values. This rule out SBP is a definite marker to screen for thyroid dysfunction among MetS subjects.

Thyroid function	Men DBP (mmHg)	Women DBP (mmHg)
MetS with SCH	88	84.5
MetS with euthyroid	88.5	85.7

MetS: Metabolic syndrome, SCH: Subclinical hypothyroidism, DBP: Diastolic blood pressure

Of the 18 women with both MetS and SCH, nine had a DBP value >85 mmHg. Of the three men with both MetS and SCH, one had DBP value >85 mmHg.

When compared to their euthyroid counterparts, both men and women with MetS and SCH had similar DBP values.

DISCUSSION

In our study, of 100 MetS, majority were in the 30–40 years age group, highlighting the at-risk population. Fast changing food habits and sedentary lifestyle pattern, in the past two decades, could be the answer for this metabolic abnormality.

The prevalence of MetS in women is >2 times, compared to men, in this study. The prevalence of SCH in MetS was found to be 21% when compared to only 6% in the control population. This association with SCH is more frequent among women.

The thyroid dysfunction in MetS is statistically significantly associated with the serum triglycerides followed closely by the WC. This association is not found with the other components of MetS.

CONCLUSION

Due to the alarming rise, in CV mortality and morbidity, the people at risk have to be identified at the earliest and their risk factors modified. Hence, diagnosing MetS should become a routine practice among the medical fraternity.

Screening for thyroid dysfunction, in MetS, especially those with elevated triglycerides, has to become a part of treatment.

Patients diagnosed to have a double jeopardy, of MetS with SCH, should be intensively treated, with life-style

interventions and if needed, with pharmacological therapy, to achieve the desired therapeutic targets.

Limitations

There are few limitations of the present study, first is, this being a cross-sectional study, a cause and effect relationship could not be determined. Further, large-scale cohort study is needed to evaluate the deleterious effect of SCH on cardiovascular disease and metabolic functions. Second, this study did not find the association between TSH and many components of MetS, the reason might be there were only few subjects with SCH. Therefore, large epidemiological studies are needed to evaluate the relationship between SCH in patients with MetS.

Scope for Future Study

The reason for SCH, among MetS, could be cytokine-mediated injury. MetS is a well-known pro-inflammatory state, causing excess release of interleukins and interferons.

This augmented cytokine release may mediate injury to thyroid follicles, exposing the enzymes on the apical border of follicles to TPO antibodies which may then bind to autoantigens and fix the complement, leading to hypothyroidism. This proposed mechanism has to be scientifically studied, by comparing these inflammatory markers against TSH and TPO antibody.

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