



## STUDY OF THYROID FUNCTION IN PATIENTS WITH METABOLIC SYNDROME

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## ABSTRACT

**INTRODUCTION:** Metabolic Syndrome (METS) is a cluster of metabolic abnormalities among those people who are obese and hypertensive, high level of triglyceride level, low high-density lipoprotein and fasting glucose levels are abnormal. Conditions such as atherogenic dyslipidemia, hyperglycemia, prothrombotic and pro inflammation are the characteristics and symptoms of METS.

**AIMS AND OBJECTIVES:** To study the relation between thyroid function and metabolic syndrome and to study nature and frequency of thyroid dysfunction.

**MATERIALS AND METHODS:** This observational prospective study was conducted on 60 patients diagnosed with metabolic syndrome and those who fulfilled the inclusion and exclusion criteria, attending medicine OPD in Geetanjali Medical College Hospital, Udaipur. The patients who fulfilled the criteria for metabolic syndrome by NCEP III criteria were taken into the study.

**RESULT:** In age group 41-60 years (55%) with metabolic syndrome. In India, the prevalence of MS is increasing due to increasing urbanization, increased intake of junk foods, and reduced physical activity. Past history of diabetes mellitus (26.7%), hypertension (20%) and ischemic heart disease (15%) were present.

**CONCLUSION:** Metabolic syndrome is a grouping of risk factors of metabolic origin that are linked to an increased risk of cardiovascular disease, necessitating the development of measures to regulate this syndrome and its component disorders. There is also a need to identify and treat more aggressively patients with metabolic syndrome who have an absolute cardiovascular risk.

## KEYWORDS : TSH, METS, ATP

## INTRODUCTION

Metabolic Syndrome (METS) is a cluster of metabolic abnormalities among those people who are obese and hypertensive, high level of triglyceride level, low high-density lipoprotein and fasting glucose levels are abnormal.<sup>1</sup>

Conditions such as atherogenic dyslipidemia, hyperglycemia, prothrombotic and pro inflammation are the characteristics and symptoms of METS. Some of the common risk factors which are responsible for the development of METS are obesity, insulin resistance, physical inactivity, advanced age and hormonal imbalance. Among all these factors, obesity is the key component of METS and it occurs due to increase in energy intake, decrease in energy expenditure or combination of both.

Thyroid dysfunction is condition that affects the thyroid gland, a butterfly-shaped gland in the front of the neck. The thyroid has important role in regulation of numerous metabolic processes throughout the body. Either structure or function of body are affected by different types of thyroid disorders.<sup>2</sup>

Hyperthyroidism is a condition when the thyroid gland makes too much thyroid hormone and the body uses energy too quickly, and because of this person feel more tired and it can make heart beat faster, cause weight loss without trying and even makes feeling nervous.

On the other side, if thyroid gland make too little thyroid hormone than this condition is called hypothyroidism. When there is too little thyroid hormone in body, it can make feel tired, weight gain and inability to tolerate cold temperatures.

The association between thyroid disease and atherosclerotic cardiovascular disease can be clarified by thyroid hormones regulation of lipid metabolism and its effect on blood pressure at some extent. Thyroid hormone appears to serve as a general pacesetter accelerating metabolic process. Therefore, thyroid hormone dysfunction is associated with metabolic syndrome.<sup>3</sup>

Thus, both metabolic syndrome and thyroid dysfunction are associated with increased risk of atherosclerotic heart disease. Information regarding relationship between

metabolic syndrome and thyroid dysfunction is very less because only few studies have been performed to see its relationship.<sup>4</sup>

## AIMS AND OBJECTIVES

To study the relation between thyroid function and metabolic syndrome. To study nature and frequency of thyroid dysfunction.

## MATERIALS AND METHODS

This observational prospective study was conducted on 60 patients diagnosed with metabolic syndrome and those who fulfilled the inclusion and exclusion criteria, attending medicine OPD in Geetanjali Medical College Hospital, Udaipur during the period of January 2020 to June 2021.

The patients who fulfilled the criteria for metabolic syndrome by NCEP III criteria were taken into the study.

NCEP ATP III CRITERIA INCLUDES: At least three or more of the following:

|                        |   |
|------------------------|---|
| Central Obesity        | Waist circumference > 102 cm for males & > 88 cm for females                    |
| Hypertriglyceridemia   | Triglycerides $\geq$ 150mg/dl   |
| Low HDL cholesterol    | HDL < 40mg/dl in males & HDL < 50mg/dl in females                               |
| Hypertension           | Blood pressure $\geq$ 135/85 mm Hg  |
| Fasting plasma glucose | $\geq$ 110mg/dl OR specific medication OR previously diagnosed type 2 diabetes. |

Patients with primary Thyroid disorder, have had irradiation of Thyroid gland, have undergone thyroidectomy / thyroid surgeries and are on Anti-thyroid drugs, drugs that alter thyroid functions and lipid levels such as Statins, Lithium, Amiodarone and Oral contraceptive pills were excluded.

Detailed history of medication, and anthropometric measurements like height, weight, waist circumference were noted in a semi-structured proforma. Blood pressure was recorded in right upper limb in sitting posture.

After eight hours of fasting, blood drawn for fasting blood

sugar, lipid profile and thyroid assay in a single sitting.

### Definitions

Euthyroidism is defined as

- TSH – 0.4 mIU/L to 4.5 mIU/L
- T4 – 5.4 microg/dl to 11.7 microg/dl

Sub clinical hypothyroidism

- TSH – 4.51 mIU/L to 10.0 mIU/L
- T4 – 5.4 microg/dl to 11.7 microg/dl

Hypothyroidism

- TSH – > 10.0 mIU/L
- T4 – < 5.70 ng/dl

Sub clinical Hyperthyroidism

- TSH – 0.1 mIU/L to 0.4 mIU/L
- T4 – 5.4 microg/dl to 11.7 microg/dl

Hyperthyroidism

- TSH – < 0.1 mIU/L
- T4 – > 11.7 microg/dl

### RESULT AND DISCUSSION

The metabolic syndrome could be 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 who have metabolic syndrome are at a higher risk of acquiring type 2 diabetes and cardiovascular disease. Hypothyroidism is related to lipid abnormalities like high triglycerides and low high-density lipoproteins, weight gain, glucose intolerance and hypertension. Thus, hypothyroidism mimics the parameters of metabolic syndrome.

**Table 1: Symptoms Wise Distribution**

| Symptoms            | No. of patients (N=60) | PERCENTAGE |
|---------------------|------------------------|------------|
| Chest Pain          | 14                     | 23.3%      |
| Uneasiness          | 14                     | 23.3%      |
| Fatigability        | 12                     | 20.0%      |
| Giddiness           | 12                     | 20.0%      |
| Headache            | 11                     | 18.3%      |
| Breathlessness      | 7                      | 11.6%      |
| Polyuria/polyphagia | 2                      | 3.3%       |
| Weight Gain         | 1                      | 1.6%       |

### AGE AND GENDER DISTRIBUTION:

| Study                           | Age in years | Males         | Females       |
|---------------------------------|--------------|---------------|---------------|
| Singh B et al <sup>5</sup>      | 47.6         | 40%           | 60%           |
| Deshmukh V et al <sup>6</sup>   | 47.9         | 41.44%        | 58.56%        |
| Chakradhar M et al <sup>7</sup> | 54.63        | 29.2%         | 70.8%         |
| Uma MA et al <sup>8</sup>       | 59.55        | 46.73%        | 53.26%        |
| <b>Present study</b>            | <b>58.83</b> | <b>41.17%</b> | <b>58.83%</b> |

In the present study age incidence was more between the age group 41-60 years (55%) with metabolic syndrome which is compared to the other studies. In India, the prevalence of MS is increasing due to increasing urbanization, increased intake of junk foods, and reduced physical activity.

Furthermore, females outnumbered males in metabolic syndrome (58.83%), which is consistent with another research. Abdominal adipose tissue is a primary source of free fatty acids and cytokines for the liver in females, encouraging the early development of insulin resistance, dyslipidemia, and high blood pressure.

As a result, women require a greater level of adiposity to generate the same metabolic abnormalities. This might be explained by women's more favorable fat distribution. As a result, the majority of the women in our research were postmenopausal, with an android distribution of fat.

### RISK FACTORS

| Study                       | H/o DM        | H/o HTN    | H/o IHD    |
|-----------------------------|---------------|------------|------------|
| Karnam M et al <sup>9</sup> | 89.8%         | 62.2%      | -          |
| <b>Present study</b>        | <b>26.67%</b> | <b>20%</b> | <b>15%</b> |

In our study past history of diabetes mellitus (26.7%), hypertension (20%) and ischemic heart disease (15%) were present. Compared to other studies known diabetic patients, hypertensive patients and IHD patients were less in our study as compared **Karnam M et al<sup>9</sup>**

### Component Of Metabolic Syndrome

| Component of metabolic syndrome | Present study         | Khatiwad α S et al <sup>10</sup> | Uma MA et al <sup>8</sup> |
|---------------------------------|-----------------------|----------------------------------|---------------------------|
| Waist Circumference (cm)        | <b>96.68 ± 8.31</b>   | 102.5 ± 6.7                      | 95.64 ± 6.61              |
| Systolic Blood Pressure (mmHg)  | <b>135.06 ± 26.09</b> | 129.3 ± 13.6                     | 140.7 ± 15.26             |
| Diastolic Blood Pressure (mmHg) | <b>85.61 ± 6.44</b>   | 84.9 ± 11.5                      | 88.95 ± 8.88              |
| Triglyceride (mg/dL)            | <b>172.81 ± 26.63</b> | 198.2 ± 90.8                     | 171.60 ± 58.54            |
| HDL (mg/dL)                     | <b>42.1 ± 6.77</b>    | 49.9 ± 15.3                      | 44.44 ± 7.59              |
| FBS (mg/dL)                     | <b>123.96 ± 58.07</b> | 126.2 ± 50.4                     | 145.46 ± 43.84            |

Low HDL-C was the most prevalent individual component with mean values lower in the metabolic syndrome group (42.1 ± 6.77) which is comparable to above mentioned study of **Uma MA et al<sup>8</sup>** (95.64 ± 6.61 mg/dL) and lower with **Khatiwada S et al<sup>10</sup>** (102.5 ± 6.7 mg/dL) study.

High Triglyceride was the next major component prevalent in the METS group. The serum Triglyceride was also found to be very high in the present study (172.81 ± 26.63 mg/dl) compared to the other study such as **Khatiwada S et al<sup>10</sup>** (198.2 ± 90.8 mg/dL) and **Uma MA et al<sup>8</sup>** (171.60 ± 58.54 mg/dL) respectively.

The hypertension or BP ≥ 130/80 was present in (73.1%) which is high when compared to **Khatiwada S et al<sup>10</sup>** study and lower to **Uma MA et al<sup>8</sup>** study.

The Waist Circumference was higher in the present study (96.68 ± 8.31 cm) compared to the other studies.

Metabolic abnormalities associated with cardiovascular risk factors can be detected at a lower WC in Asians compared to Caucasians, implying that the NCEP ATP III criteria may underestimate the incidence of metabolic syndrome in Asians. In future studies on Asian Indians and other Asian ethnic populations, IDF-2005 may be regarded as defining factors, particularly WC measures for metabolic syndrome.

### Prevalence Of Thyroid Component:

| TSH Grade                | Present study | Chakradhar M et al <sup>7</sup> | Uma MA et al <sup>8</sup> | Baidya A et al <sup>11</sup> | Khatiwad α S et al <sup>10</sup> |
|--------------------------|---------------|---------------------------------|---------------------------|------------------------------|----------------------------------|
| Euthyroid                | <b>76.66%</b> | 71.6%                           | 81.53%                    | 80%                          | 68.2%                            |
| Subclinical Hypothyroid  | <b>16.66%</b> | 15.7%                           | 14.13%                    | 16.4%                        | 26.6%                            |
| Hypothyroid              | <b>5%</b>     | 8.2%                            | 4%                        | 3.6%                         | 3.5%                             |
| Subclinical Hyperthyroid | <b>1.66%</b>  | 4.5%                            | 0%                        | 0%                           | 1.7%                             |

Thyroid dysfunction was shown to be prevalent in 23.33 % of metabolic syndrome individuals in this investigation. Hypothyroidism affects 21.66% of patients with metabolic syndrome (Overt Hypothyroidism 5% and sub clinical hypothyroidism 16.66%). Subclinical hyperthyroidism was seen in 1.66 % with metabolic syndrome. This study is

consistent with other studies done by **Chakradhar M et al<sup>7</sup>** as (28.4%), **Uma MA et al<sup>8</sup>** as (18.47%), **Baidya A et al<sup>11</sup>** as (20%), **Khatiwada S et al<sup>10</sup>** as (31.8%).

Subclinical hypothyroidism was found in one-sixth of the metabolic syndrome patients in this research, or one out of every six individuals with metabolic syndrome. In addition, one out of every thirty patients had overt hypothyroidism. Treatment with levothyroxine replacement restores the symptoms and manifestations of hypothyroidism, hence reversing the variables that contribute to metabolic syndrome in these hypothyroid patients. It is generally recognized and confirmed that treating overt or clinical hypothyroid patients with levothyroxine replacement reduces all metabolic markers and cardiovascular risk, although there is dispute in treating subclinical hypothyroidism patients. The management of individuals with subclinical hypothyroidism continues to be controversial due to a scarcity of scientific information to guide therapeutic decisions.

As the metabolic syndrome patients have hyperlipidemia, diabetes, hypertension and increased cardiovascular risk, its look logical to treat metabolic syndrome patients having sub clinical hypothyroidism by levothyroxine replacement therapy.

While there appears to be no adverse effects of initiating levothyroxine treatment during this setting, inadvertent overtreatment occurs in 14-21% of levothyroxine treated patients, carrying potential risks of osteoporosis and arrhythmia when serum TSH falls below 0.1 mIU/L. These patients need frequent thyroid function tests to avoid this complication.

#### Correlation of TSH with Metabolic Syndrome

On the basis of this study, it was found that parameters such as age, gender, Vital Parameters, Biochemical Parameters were not statically significant with abnormal thyroid dysfunction ( $p > 0.05$ ) while Waist Circumference was statistically significant between normal and abnormal thyroid function patients ( $94.52 \pm 7.49$  vs  $99.64 \pm 6.15$  cm;  $p = 0.0235$ ). This study consists with other studies such as **Chakradhar M et al<sup>7</sup>**, **Karnam M et al<sup>9</sup>** and **Baidhya A et al<sup>11</sup>**.

#### CONCLUSION

Metabolic syndrome is a grouping of risk factors of metabolic origin that are linked to an increased risk of cardiovascular disease, necessitating the development of measures to regulate this syndrome and its component disorders. There is also a need to identify and treat more aggressively patients with metabolic syndrome who have an absolute cardiovascular risk.

In addition, cardiovascular risk is observed more in patients who had both thyroid dysfunction and metabolic syndrome together with more common in female. Subclinical hypothyroidism is the most frequent thyroid malfunction in people with metabolic syndrome. Among all individual component of the metabolic syndrome waist circumference found to be significantly associated with TSH.

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