IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 23, Issue 10 Ser. 10 (October. 2024), PP 44-49
www.iosrjournals.org

Thyroid Dysfunction In Metabolic Syndrome In Patients: An Observational Study

Dr Anju Anto
Dr Balachandra A Shetty
Surumi Azees

Abstract
Objective: *To assess the clinico-demographic profile thyroid dysfunction (TD in patients with metabolic syndrome (MetS).*
Methods: *Research was done at the Medical Department. We included 200 MetS patients in this investigation. Demographics, anthropometric measurements, significant medical (including FPG, serum TG, and HDL-C values from patients' medical records) and surgical history, family history, lifestyle parameters, history of obesogenic medicine use, vital signs, and physical examination details were collected in case report forms at the screening visit.*
Results: *We included 200 MetS patients in this investigation. The baseline demographics of these patients are presented. Of the recruited patients, 60 (30%) had TD, with women being more likely than males. Overt hypothyroidism was detected in 36 of 200 MetS patients and hyperthyroidism in 4. High waist circumference, lowered HDL-C, elevated HOMA-IR, systolic and diastolic blood pressure, fasting hyperglycemia, and TG were seen in TD patients in this research. More women than men had waist circumferences exceeding 80 cm.*
Conclusion: *Metabolic syndrome complications include thyroid problems. High frequency of TD in MetS patients suggests a thyroid-MetS interaction. This investigation will help link TD and MetS in Indian patients. Early identification of TD in MetS may help change disease course with lifestyle modifications.*
Keywords: *Metabolic Syndrome, Hypothyroidism, Subclinical hypothyroidism, thyroid dysfunction*

Date of Submission: 16-10-2024 Date of Acceptance: 26-10-2024

I. Introduction

Metabolic syndrome (MetS) and hypothyroidism are well recognised as precursors of atherogenic cardiovascular disease. Metabolic syndrome (MetS) is a collection of risk factors that are characterised by high blood pressure, abnormal levels of lipids in the blood, elevated blood sugar levels, and circumstances that promote blood clotting and inflammation. These variables contribute to the development of atherosclerosis, a process that leads to the formation of plaque in the arteries.[1,2] Hypothyroidism is well recognised for its association with hyperlipidaemia, diastolic hypertension, endothelial dysfunction, and cardiovascular disease.[3,4] There is a significant overlap in the disease-causing pathways of atherosclerotic cardiovascular disease due to Metabolic Syndrome (MetS) and hypothyroidism. Insulin resistance is considered the fundamental pathological mechanism in Metabolic Syndrome (MetS).[5,6] Recent investigations have revealed that insulin resistance plays a significant role in the development of dyslipidaemia in individuals with hypothyroidism.[7]

Several recent investigations have shown a clear link between metabolic syndrome and thyroid dysfunction. Thyroid dysfunction refers to changes in the levels of thyroid-stimulating hormone, with or without changes in Tri iodothyronine (T3) and Tetra iodothyronine (T4). Individuals exhibiting elevated levels of Thyroid-stimulating hormone (TSH) were shown to have a twofold increase in the occurrence of metabolic syndrome.[8] There is a correlation between subclinical hypothyroidism, which is characterised by an elevated level of thyroid-stimulating hormone (TSH), and an increased likelihood of developing coronary heart disease. Atherosclerosis and dyslipidaemia are prevalent in cases with hypothyroidism.[9]

Thyroid problems rank high in terms of their prevalence among endocrine disorders on a global scale. According to estimates from many research, it is anticipated that over 42 million individuals in India are affected by thyroid problems.[10] Metabolic syndrome (MetS) is strongly linked to thyroid dysfunction (TD) since thyroid hormones have a significant influence on lipid metabolism, glucose levels, blood pressure, and cardiovascular function.[11] The thyroid gland's functional alterations may be linked to MetS and its associated factors, such as obesity, insulin resistance (IR), abnormalities in lipid and glucose metabolism, elevated blood pressure, and cardiovascular dysfunction. Metabolic syndrome (MetS) and type 2 diabetes (TD) have a set of similar problems, including abdominal obesity, high blood sugar levels, high blood pressure, low levels of high- density

lipoprotein cholesterol (HDL-C), and high levels of triglycerides (TG). Furthermore, insulin resistance (IR), which is recognised as a fundamental mechanism for metabolic syndrome (MetS), also contributes to the development of hypothyroidism.[12] The coexistence of these illnesses might increase the chance of developing cardiovascular diseases (CVDs). The objective of this research was to assess the clinico-demographic profile thyroid dysfunction (TD in patients with metabolic syndrome (MetS).

II. Methods

The research was carried out at the Department of Medicine and the study methodology was sanctioned by local autonomous ethics committees. For this research, we recruited a total of 200 individuals diagnosed with Metabolic Syndrome (MetS).

Individuals between the ages of 18 and 65, who have been diagnosed with Metabolic Syndrome according to the criteria set by the National Cholesterol Education Program (NCEP) Adult Treatment Panel (ATP) III (with modified waist), and may or may not have a known Thyroid Disorder, were asked to take part in the research at their regular medical appointment.

The study excluded pregnant individuals, as well as patients who had undergone jejunoileal bypass, biliopancreatic diversion, extensive small bowel resection, total parenteral nutrition, or had any forms of chronic liver disease, hepatocellular carcinoma, were on weight loss therapies or steatogenic drugs, or were known to be HIV-positive.

Methodology

During the screening visit, various data were gathered and recorded in the case report forms. This included information on demographics, anthropometric measurements, relevant medical data (such as fasting plasma glucose, serum triglyceride, and HDL cholesterol values obtained from patients' medical records), surgical history, family history, lifestyle factors, history of using any medications that may contribute to obesity, vital signs, and details from the physical examination. Once the patients gave their agreement to participate in the research, they were asked to attend the clinic between 3-10 days following the screening appointment. It was required that they fast overnight before coming to the clinic. During visit 1, patients who abstained from alcohol or consumed less than 20 g per day and had not taken corticosteroids, amiodarone, or tamoxifen had an abdominal ultrasound examination (USG). Blood samples were obtained to evaluate the hemogram, coagulogram (including activated partial thromboplastin time, thrombin time, and prothrombin time), plasma insulin, plasma glucose, lipid profile (including TG, total cholesterol (TC), HDL-C, and low-density lipoprotein cholesterol (LDL-C)), and thyroid function (including free triiodothyronine (FT3), free thyroxine (FT4), and thyroid-stimulating hormone (TSH)). The fasting plasma glucose and plasma insulin were used to compute the homeostatic model assessment-established insulin resistance (HOMA-IR). The patients were monitored for an average duration of one year in order to detect any new occurrences of TD.

The main objective of the study was to determine the frequency of TD in individuals diagnosed with Metabolic Syndrome (MetS). Additional endpoints encompassed the proportion of patients exhibiting hyperthyroidism, subclinical hyperthyroidism, hypothyroidism, and subclinical hypothyroidism, as well as the percentage of patients with thyroid dysfunction in relation to specific components of Metabolic Syndrome (waist circumference, triglycerides, high-density lipoprotein cholesterol, systolic blood pressure, diastolic blood pressure, and fasting glucose) and insulin resistance (HOMA-IR > 1.64). All statistical analyses were performed using SPSS version 22.

III. Results

Table 1: Demographics and baseline characteristics of patients with metabolic syndrome

Parameter	Age ≤ 45 y (N = 90)	Age > 45 y (N = 110)	Total (N = 200)
Age in years			
Mean (SD)	38.2 (7.05)	52.8 (6.54)	48.4 (11.88)
Range	21.0-45.0	46.0-65.0	21.0-65.0
Gender			
Women, N	55	60	115
Men, N (%)	35	50	85
Height in cm, mean (SD)	164.6 (9.05)	161.9 (9.51)	162.8 (9.71)
Weight in kg, mean (SD)	80.8 (11.14)	76.4 (13.37)	78.2 (13.77)
Waist circumference in cm, mean (SD)	98.5 (9.41)	98.7 (9.92)	98.6 (9.70)
Hip circumference in cm, mean (SD)	106.3 (11.07)	104.7 (11.14)	105.4 (11.13)

We included 200 MetS patients in this investigation. The baseline demographics of these patients are

presented. Of the recruited patients, 60 (30%) had TD, with women being more likely than males. High waist circumference, lowered HDL-C, elevated HOMA-IR, systolic and diastolic blood pressure, fasting hyperglycemia, and TG were seen in TD patients in this research. More women than men had waist circumferences exceeding 80 cm.

Table 2: Percentage prevalence of different grades of thyroid dysfunction

Classification of TD	MetS patients N
Hypothyroidism	36
New overt hypothyroidism	4
New subclinical hypothyroidism	22
Hyperthyroidism	4
New overt hyperthyroidism	4
New subclinical hyperthyroidism	2
Total number of TD patients	60

Of the 200 MetS patients, overt hypothyroidism was reported in 36 patients and overt hyperthyroidism in 4 patients.

IV. Discussion

Metabolic syndrome is a collection of disorders that includes obesity, hypertension, aberrant lipid profile characterised by high triglyceride levels and low levels of high-density lipoproteins, as well as raised fasting blood sugar levels. Individuals diagnosed with metabolic syndrome are at an elevated risk of acquiring diabetes and cardiovascular illnesses in the future. Thyroid impairment is prevalent in individuals with metabolic syndrome. The incidence of thyroid dysfunction in individuals with metabolic syndrome ranges from 21% to 51%, as seen in several research done in India, Nepal, the Middle East, and African nations.Thirteen to sixteen Metabolic syndrome may be linked to both endocrine and non-endocrine illnesses and has far-reaching implications. Changes in thyroid functions, although well acknowledged, are rarely identified in a clinical setting and there is a lack of consistency in thyroid functioning in individuals with metabolic syndrome.[17]

Oxidative stress, persistent inflammation, and the formation of new blood vessels are thought to contribute to the development of Metabolic Syndrome (MetS).[18] The key elements of MetS, such as hyperglycemia and inflammation, lead to an increase in the formation of reactive oxygen species (ROS), which in turn causes a rise in oxidative stress due to the overactivation of nicotinamide adenine dinucleotide phosphate (NADPH) oxidase.[19,20] The primary reactive oxygen species (ROS) is the superoxide anion, which is generated by the enzyme NADPH oxidase. Hyperthyroidism may cause a hypermetabolic state, which speeds up the formation of free radicals in mitochondria and leads to alterations in the antioxidant defence system. Hypothyroidism leads to oxidative stress due to a decrease in the ability of the body's antioxidative defence system.

The lower prevalence of subclinical hypothyroidism cases (10%) seen in our research may be explained by the significant inclusion of patients with pre-existing hypothyroidism (17.5%) who were already receiving levothyroxine medication. The total prevalence of hypothyroidism, including both baseline cases (17.5%) and newly diagnosed cases of overt hypothyroidism (2%) and subclinical hypothyroidism (10%), was determined to be 25.70%. Consistent with our research, other Indian studies have also indicated a comparable incidence of hypothyroidism in the MetS group, namely 26% as found by Kota et al.[21]

For this research, we recruited a total of 200 individuals diagnosed with Metabolic Syndrome (MetS). The demographic features of these patients at the beginning of the study are shown. Out of all the patients that were registered, 60 individuals (30%) were diagnosed with TD. The frequency of TD was found to be greater among women in comparison to males. Individuals in the older age group (>45 years of age), regardless of gender, saw a greater occurrence of TD. The findings of our study align with previous research, indicating a consistent trend of higher TD with advancing age in both males and females.[22,23] Age and gender are important risk factors for TD in patients with MetS. Therefore, it is necessary to do a thorough clinical and laboratory examination in these specific groups.

The research found that individuals diagnosed with TD had many MetS components, including elevated waist circumference, decreased HDL-C levels, increased HOMA-IR levels, elevated systolic and diastolic blood pressure, elevated fasting glucose levels, and increased TG levels. A greater percentage of females exhibited waist circumference measurements over the designated threshold (>80 cm) in comparison to males. While other research has also shown a connection between TD and components of MetS, its validity is still a subject of debate. Research conducted in Nigeria found a strong association between Metabolic Syndrome (MetS) and higher levels of Free Thyroxine (FT4).[24] A study discovered a noteworthy correlation between

subclinical hypothyroidism and MetS in Indian patients. They observed a link between TSH levels and TC, TG, LDL, and HDL-C values.[21] Out of the 200 patients with MetS, 36 individuals had overt hypothyroidism and 4 patients had overt hyperthyroidism. It is important to mention that while investigating the connection between thyroid dysfunction (TD) and components of metabolic syndrome (MetS), the majority of research have mostly focused on subclinical hypothyroidism. Additionally, it is important to acknowledge that the occurrence of TD in MetS and its correlation with its components might differ depending on geographical location, age, gender, nutrition, genetics, and environmental variables.[25,26]

V. Conclusion

Thyroid dysfunction is a significant occurrence that may arise as a consequence in people with metabolic syndrome. The occurrence of thyroid dysfunction (TD) in individuals with metabolic syndrome (MetS) was shown to be significant, suggesting a potential interaction between thyroid function and MetS. The data obtained from this research will help establish an association between TD (thyroid dysfunction) and MetS (metabolic syndrome) in Indian patients. An early identification of TD in MetS would facilitate the adjustment of the disease progression by timely therapies using suitable lifestyle modification regimens, when necessary. Nevertheless, it is necessary to conduct future research with a significant number of participants in order to assess the effects of TD therapy on the decrease of MetS and its associated factors.

References

[1] Eckel Rh, Grundy Sm, Zimmet Pz. The Metabolic Syndrome. The Lancet. 2005 Apr 16;365(9468):1415-28.
[2] Grundy Sm. Metabolic Syndrome: Connecting And Reconciling Cardiovascular And Diabetes Worlds. Journal Of The American College Of Cardiology. 2006 Mar 21;47(6):1093-100.
[3] Hak Ae, Pols Ha, Visser Tj, Drexhage Ha, Hofman A, Witteman Jc. Subclinical Hypothyroidism Is An Independent Risk Factor For Atherosclerosis And Myocardial Infarction In Elderly Women: The Rotterdam Study. Annals Of Internal Medicine. 2000 Feb 15;132(4):270-8.
[4] Fernández-Real Jm, López-Bermejo A, Castro A, Casamitjana R, Ricart W. Thyroid Function Is Intrinsically Linked To Insulin Sensitivity And Endothelium-Dependent Vasodilation In Healthy Euthyroid Subjects. The Journal Of Clinical Endocrinology & Metabolism. 2006 Sep 1;91(9):3337-43.
[5] Reaven Gm. Role Of Insulin Resistance In Human Disease. Diabetes. 1988 Dec 1;37(12):1595-607.
[6] Defronzo Ra, Ferrannini E. Insulin Resistance: A Multifaceted Syndrome Responsible For Niddm, Obesity, Hypertension, Dyslipidemia, And Atherosclerotic Cardiovascular Disease. Diabetes Care. 1991 Mar 1;14(3):173-94.
[7] Singh Bm, Goswami B, Mallika V. Association Between Insulin Resistance And Hypothyroidism In Females Attending A Tertiary Care Hospital Indian J Clin Biochem. 2010;25:141–5
[8] Oh Jy, Sung Ya, Lee Hj. Elevated Thyroid Stimulating Hormone Levels Are Associated With Metabolic Syndrome In Euthyroid Young Women. Korean J Intern Med 2013;28(2):180-6.
[9] Nah Eh, Lee Jg. The Relationship Between Thyroid Function And The Risk Factors Of Cardiovascular Disease At Female Medical Checkups. Korean J Lab Med 2009;29(4):286-92.
[10] Unnikrishnan Ag, Menon Uv. Thyroid Disorders In India: An Epidemiological Perspective. Indian Journal Of Endocrinology And Metabolism. 2011 Jul;15(Suppl2):S78.
[11] Liu Yy, Brent Ga. Thyroid Hormone Crosstalk With Nuclear Receptor Signaling In Metabolic Regulation. Trends In Endocrinology &Amp; Metabolism. 2010 Mar 1;21(3):166-73.
[12] Singh Bm, Goswami B, Mallika V. Association Between Insulin Resistance And Hypothyroidism In Females Attending A Tertiary Care Hospital. Indian Journal Of Clinical Biochemistry. 2010 Apr;25:141-5.
[13] Shrestha S, Das Bkl, Baral N, Et Al. Association Of Metabolic Syndrome And Its Components With Thyroid Dysfunction In Females. Int J Diab Dev Countries 2007;27(1):24- 6.
[14] Uzunlulu M, Yorulmaz E, Oguz A. Prevalence Of Subclinical Hypothyroidism In Patients With Metabolic Syndrome. Endocr J 2007;54(1):71-6.
[15] Deshmukh V, Farishta F, Bhole M. Thyroid Dysfunction In Patients With Metabolic Syndrome: A Cross-Sectional, Epidemiological, Pan-India Study. International Journal Of Endocrinology. 2018 Dec 25;2018.
[16] Gyawali P, Takanche Js, Shrestha Rk, Et Al. Pattern Of Thyroid Dysfunction In Patients With Metabolic Syndrome And Its Relationship With Components Of Metabolic Syndrome. Diabetes Metab J 2015;39(1):66-73.
[17] Chugh K, Goyal S, Shankar V, Chugh Sn. Thyroid Function Tests In Metabolic Syndrome. Indian Journal Of Endocrinology And Metabolism. 2012 Nov;16(6):958.
[18] Mahjoub S, Masrour-Roudsari J. Role Of Oxidative Stress In Pathogenesis Of Metabolic Syndrome. Caspian Journal Of Internal Medicine. 2012;3(1):386.
[19] Hopps E, Noto D, Caimi G, Averna Mr. A Novel Component Of The Metabolic Syndrome: The Oxidative Stress. Nutrition, Metabolism And Cardiovascular Diseases. 2010 Jan 1;20(1):72-7.
[20] Vanessa Fiorentino T, Prioletta A, Zuo P, Folli F. Hyperglycemia-Induced Oxidative Stress And Its Role In Diabetes Mellitus Related Cardiovascular Diseases. Current Pharmaceutical Design. 2013 Oct 1;19(32):5695-703.
[21] Meher Lk, Raveendranathan Sk, Kota Sk, Sarangi J, Jali Sn. Prevalence Of Hypothyroidism In Patients With Metabolic Syndrome. Thyroid Research And Practice. 2013 May 1;10(2):60.
[22] Meng Z, Liu M, Zhang Q, Liu L, Song K, Tan J, Jia Q, Zhang G, Wang R, He Y, Ren X. Gender And Age Impacts On The Association Between Thyroid Function And Metabolic Syndrome In Chinese. Medicine. 2015 Dec;94(50).
[23] Tehrani Fr, Tohidi M, Dovom Mr, Azizi F. A Population Based Study On The Association Of Thyroid Status With Components Of The Metabolic Syndrome. J Diabetes Metab. 2011;2(8):156-68.
[24] Udenze I, Nnaji I, Oshodi T. Thyroid Function In Adult Nigerians With Metabolic Syndrome. Pan African Medical Journal. 2014;18(1).
[25] Shantha Gp, Kumar Aa, Jeyachandran V, Rajamanickam D, Rajkumar K, Salim S, Subramanian Kk, Natesan S. Association Between Primary Hypothyroidism And Metabolic Syndrome And The Role Of C Reactive Protein: A Cross–Sectional Study

From South India. Thyroid Research. 2009 Dec;2(1):1-7.
[26] Tseng Fy, Lin Wy, Lin Cc, Lee Lt, Li Tc, Sung Pk, Huang Kc. Subclinical Hypothyroidism Is Associated With Increased Risk For All-Cause And Cardiovascular Mortality In Adults. Journal Of The American College Of Cardiology. 2012 Aug 21;60(8):730-7.