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Study of Metabolic Syndrome and Thyroid Dysfunction

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Abstract

Metabolic Syndrome is a group of factors that predispose to cardiovascular diseases. The prevalence of metabolic syndrome is rising rapidly. Recently, a few studies have suggested that thyroid function in the reference range may be associated with metabolic syndrome, but the issue remains unsettled. We aimed to elucidate the relationship between thyroid function and components of metabolic syndrome.

Aims: *1. To find out the status of thyroid dysfunction in subjects with metabolic syndrome*

Methodology: *Study was conducted at the N.K.P.Salve Institute of Medical Sciences and Research. It was a hospital-based, cross-sectional study. Seventy patients (n=70) with metabolic syndrome, fulfilling National Cholesterol Education Program (NCEP) Adult Treatment Panel III were subjected to thyroid function tests (fT_3 , fT_4 and TSH) and were included in this study with their consent. A detailed history was taken and clinical examination done. Details like anthropometric measurement of height, weight, waist circumference and systolic and diastolic blood pressure were noted. Fasting blood glucose, triglycerides and HDL-C were estimated in all subjects. Relationship between thyroid function and metabolic syndrome was studied. Diagnosis of the metabolic syndrome was made when 3 or more of the risk determinants were present.*

Statistical Analysis: *Data was expressed as mean ± standard deviation and analyzed by using one-way ANOVA followed by Student's 't' test.*

Results: ↑ waist circumference in 71.1%, hypertension in 59%, ↑ triglyceride levels in 62%, ↓ HDL-C in 60.8%, impaired fasting glucose in 58%, TSH > 6 mIU/ml in 37%. The metabolic syndrome was present in 54% of the patients. Increased wait circumference was the most common metabolic abnormality in both sexes.

Conclusion: *Metabolic syndrome was present in 54%, with higher prevalence in females owing increased obesity. Most common abnormality seen was increased waist circumference followed by increased in triglycerides and decrease in HDL-C levels. Prevalence of hypertension was observed to be increasing with age. 37% of patients had increased in TSH levels.*

Keywords: *metabolic syndrome, TSH, fT3, fT4.*

Introduction

Metabolic syndrome[1] (MS) is a group of risk factors that predispose to cardiovascular diseases (CVD). They include: central obesity, raised triglycerides (TG), low high-density lipoprotein cholesterol (HDL-C), raised blood pressure (BP) and raised fasting blood glucose. Presence of three or more of these risk factors indicates MS. It is also associated with a pro-thrombotic and a pro-inflammatory state.[2] The MS has reached epidemic proportions in most countries.[3] Prevalence of MS in USA has been found to be 23.7%.[4] It is becoming one of the major health issues in developing countries including those of Asia which increasingly have chronic non-communicable diseases along with infectious diseases and under-nutrition. Metabolic syndrome was found to be highly prevalent (77.2%) in an urban Indian diabetic cohort with greater prevalence in women than men.[5] Insulin resistance is a common underlying pathogenic mechanism. It has been suggested that TG levels and TG/HDL-C ratio are surrogate markers for insulin resistance.[6] Also, multiple products are released from white adipose tissue, which have been implicated in development of MS. These include: non-esterified fatty acids (NEFAs), inflammatory cytokines, plasminogen activator inhibitor-1 and resistin.[7]

Recent studies have given evidence about the role of inflammatory cytokines as a common immunological factor for metabolic syndrome and thyroid dysfunction[8]. It has been postulated that cytokine mediated injury to thyroid follicle might lead to subclinical hypothyroidism in patients with metabolic syndrome. Therefore, the aim of this study was to investigate the prevalence of the metabolic variable in metabolic syndrome as well as any associated thyroid dysfunction with the metabolic syndrome.

Methodology

70 patients attending the thyroid clinic as well as outdoor patients who fulfilled the diagnostic criteria as per WHO as well as ATP-III terms were included in the study. Any patient having significant renal disease, hepatic disease, or is immobile, or having a myocardial condition, or pregnancy was excluded from the study. After taking the history (especially of smoking, alcohol, physical activities, diabetes and hypertension), physical examination was conducted which included height, weight, BP, and abdominal girth. They were further subjected to blood investigations like fasting blood sugar, complete lipid profile, T3, T4, TSH estimation. The thyroid hormone assays (fT_3 , fT_4 and TSH) was done using CHEMILUMINESENCE IMMUNO ASSAY, LUMAX 4101, MONOBIND INC., USA KIT; and triglycerides and HDL-C were done enzymatically on Vitalab Selectra-MERCK Clinical Chemistry Analyzer.

The biochemical variables and abnormalities as defined as per NCEP ATP-III criteria are, i.e., abdominal obesity 102 cm and 88 cm in men and women respectively, triglycerides > 150 mg/dl; HDL concentration < 40 mg/dl in men and < 50 mg/dl in women; BP > 130/85 mmHg; and fasting glucose > 100 mg/dl < 126 mg/dl.

Results

The study group (n = 70) compromised of 18 males and 52 females within the age 40 – 70 years. Prevalence of abnormalities based on the pre-defined values and details were: ↑ waist circumference in 71.1%, hypertension in 59%, ↑ triglyceride levels in 62%, ↓ HDL-C in 60.8%, impaired fasting glucose in 58%, TSH > 5 mU/ml in 37%. The metabolic syndrome was present in 54% of the patients. Increased wait circumference was the most common metabolic abnormality in both sexes.

In people below the age of 50, low HDL-C was the most common abnormality but the prevalence of hypertension increased gradually with age and became the most prevalent abnormality after 50 years of age.

TSH levels were high (>5 mIU/ml) in 28% of women and 9% men. The prevalence of the abnormality was common in 30 – 39 years of age in women, while in men the prevalence was high in the age group of 50 - 59 years.

Elevated triglycerides, low HDL-C, and increased waist scircumference were most common in women, while elevated TG, low HDL-C, and hypertension (triad) were more common in men.

The mean serum TSH was 2.61 mU/l. Subjects in the upper quartile with a serum TSH level above 5 mIU/l (odds ratio (OR)Z 1.78; 95% confidence interval (CI) 1.19–2.37) had a significantly increaseeed prevalence of metabolic syndrome compared with subjects in the lowest quartile with a serum TSH below 5 mIU/l. After adjustment for confounders, age, sex, alcohol use, total physical activity, and smoking, the OR was 1.72 (95% CI 1.15–2.32).

Discussion

Metabolic syndrome is one of the major public health issues of this century. This is a constellation of physical condition and metabolic abnormalities commonly found in association, which increases individual risk for development of type 2 diabetes mellitus, cardiovascular diseases and its sequelae. The reported overall prevalence of metabolic syndrome in adults over the age of 20 years is 24%, but the age-specific rate increases rapidly. [11]. Therefore, early identification of the metabolic abnormality and appropriate intervention may be of primary importance in those populations who are having a high prevalence of these disorders.

In the present study, the prevalence of metabolic syndrome was 54%. Most common abnormality detected based on the pre-defined values and details was increased waist circumference in 71.1% followed by increased triglyceride levels in 62% and decreased HDL-C in 60.8%.while hypertension was seen in 59%, , impaired fasting glucose in 58% and TSH > 5 mIU/ml in 37% of subjects with metabolic syndrome. It was also observed that subjects with higher TSH levels (> 5 mIU/ml) had significant increased risk of metabolic syndrome.

This can be explained through the metabolic and inflammatory pathways.

Inflammation, both acute and chronic, is an energy-consuming phenomenon. To fuel the inflammatory state and sustain it, energy has to be

continuously provided. Therefore, inflammatory cytokines such as TNF-alpha and various interleukins can affect insulin sensitivity locally at their site of production as well as in distant adipose tissues[9]. Similarly adipokines can affect inflammation at different sites. TNF-alpha, interlukin-6, and platelets activator inhibitor are major proinflammatory adipokines; adiponectin has emerged as a major insulin sensitizing and antifibrotic adipokine. Thus, inflammation begets insulin-resistance, and insulin-resistance perpetuates inflammation. Various studies have supported the notion of chronic inflammatory states producing insulin resistance and vice-versa. It is well established that obesity and insulin-resistance are directly related to chronic inflammation associated with atherosclerosis[10]. There is a strong association of rheumatoid arthritis with subclinical hypothyroidism[11]. Cytokines depend upon the gene composition of an individual, site of adipose tissue, the type and degree of nutrients that are being consumed, hormonal factors from local areas as well as from distant organs, and site of inflammation. The activity of the insulin is modulated by both systemic counterregulatory hormones (e.g., growth hormone, thyroxin, and glucagons) as well as the above factors.

Cytokine-mediated injury to thyroid follicles could expose the enzymes on the apical border of follicles to TPO antibodies which may then bind to autoantigens and fix the complement leading to hypothyroidism15. Various studies have reported the prevalence of subclinical hypothyroidism in metabolic syndromes varying from 16.4% to 26%[12,13]. The predominant functions of adipose tissue are either to store or to mobilise lipids. The degree to which each of these functions is performed depends upon the expression of an array of cytokines by adipose tissue. The adipocytokines are biologically active polypeptides that are produced either exclusively or substantially by adipocytes and act by the endocrine, parocrine, or autocrine mechanisms. Such adipokines may be broadly thought to be those that promote lipogenesis (insulin like cytokines) and those that promote lipid mobilization (insulin-resistance promoting cytokines). As seen in our study group, the high TSH level was present in 28%, so patients presenting with metabolic syndrome should be assessed for thyroid dysfunction and further studies regarding correlation of metabolic syndrome and thyroid dysfunction especially in the genetic field may provide further insight in this area in the near future.

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