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Research Article

Prevalence of Thyroid Dysfunction in Turkish Patients with Metabolic Syndrome: A Cross-Sectional Study

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Abstract

Background: The aim of this study was to investigate the prevalence of thyroid dysfunction in patients with metabolic syndrome.

Methods: A total of 259 subjects were enrolled in this cross-sectional study in two groups; 145 patients in metabolic syndrome group and 114 subjects in control group. Frequency of all types of thyroid dysfunction (including hypo-hyperthyroidism and subclinical forms) and euthyroidism were calculated and compared between two groups.

Results: Frequency of total thyroid dysfunction and subclinical hypothyroidism were higher in patients with metabolic syndrome. There was statistically significant difference between the groups (p=0.04, 0.01, respectively).

Conclusion: Patients with metabolic syndrome have an increased risk for thyroid dysfunction and consequently, an increased risk for cardiovascular diseases. Deleterious effects of thyroid dysfunction on cardiovascular and metabolic function calls for a systematic approach to thyroid disease screening in metabolic syndrome.

Keywords: Thyroid dysfunction; Metabolic syndrome; Hypothyroidism; Hyperthyroidism

Introduction

Metabolic syndrome is a cluster of metabolic abnormalities that includes hypertriglyceridemia, low levels of high-density lipoprotein cholesterol, obesity, hypertension and hyperglycemia. Insulin resistance, physical inactivity and hormonal imbalance were common underlying risk factors [1,2]. Consequently, metabolic syndrome is a risk factor for development of cardiovascular diseases [3]. Metabolic syndrome is a common metabolic disorder in Turkey. The prevalence of metabolic syndrome of our country is higher than the prevalence of developed countries, and some of neighbouring countries. It is 35% in Turkey while it is approximately 25% in developed countries, 23.6% in Greek, 34.7% in Iran [3-6]. The prevalence of metabolic syndrome is also high in Bulgaria as another neighbouring country [7].

Thyroid dysfunctions; subclinic forms or overt forms, are common endocrin disorders in the genaral population. Thyroid dysfunctions are associated with atherosclerosis and cardiovascular diseases [8]. Previous studies have shown that lipid metabolism, insulin resistance and blood pressure are effected by thyroid hormones [9,10].

According to these studies, it is clear that patients with metabolic syndrome and thyroid dysfunctions have an increased risk for development of cardiovascular diseases [8-10]. The aim of this study was to investigate frequency of thyroid dysfunctions in Turkish patients with metabolic syndrome.

Material and Methods

This cross-sectional study was carried out in the internal medicine outpatient clinics of the Adana Numune Training and Research Hospital in from September 2012 to February 2013. We analysed 259 patients in 2 groups; one group consisting of 145 metabolic syndrome patients and a control group consisting of 114 subjects without metabolic syndrome. Approval for the study protocol was granted by the hospital's institutional review board, and the study was conducted in accordance with the Declaration of Helsinki. Patients which are taking any medication that could alter thyroid hormone concentrations, lipid levels, and patients with a history of thyroid diseses, pregnancy, malignancy, liver disorders, renal failure, cardiac failure, hypothalamic or pituitary disease were excluded.

Collection of the data in this study included the following tests: Blood chemistry, body mass index, waist circumference and blood pressure. Blood pressure of patients was measured after 10 minute of rest with periodically calibrated sphygmomanometers (Erka, Germany) at least two times in two distinct days. One reading was taken for the patients with hypertension. The waist circumference was measured at the plane between the anterior superior iliac spines and between the lower costal margins at the norrowest part of the waistline. Body mass index (BMI) was calculated as body weight in kilograms divided by the square of the participant's height in meters. A venous blood sample was collected in the morning of overnight fasting. We measured TSH, FT3, FT4, fasting glucose and serum lipids. TSH, FT3, FT4 levels were measured by Abbott Architect I 2000 SR analyzer system (Illiniosis, USA). Fasting glucose, triglyceride, high-density lipoprotein cholesterol (HDL-C) were analysed with an automatic analyzer (Roche C-501, Tokyo, Japan) by using hexocinase methot (glucose) and homogeneous colorimetric enzyme test (triglyceride and HDL-C). The metabolic syndrome was defined according to the National Cholesterol Education Program Third Adult Treatment Panel Guidelines (NCEP ATP III). The components of metabolic syndrome were noted as waist circumference > 102 cm in men or >88 cm in women, triglycerides ≥ 150 mg per 100 ml, HDL-C < 40 mg per 100 ml in men or < 50 mg per 100 ml in women, blood pressure ≥ 130/85 mmHg, and fasting glucose ≥ 100 mg per 100 ml. The metabolic syndrome was defined as having at least three of the five components. Patients with a high TSH level with low FT4 level, with a high TSH level with normal FT4 level, with a low TSH level with high FT4 or FT3 level, with a low TSH level with normal FT4 and FT3 level, with normal TSH and FT4 were considered as hypothyroidism, subclinical hypothyroidism, hyperthyroidism, subclinical hyperthyroidism, euthyroid, respectively.

MedCalc 12.7 software program (MedCalc, Turkey) was used for statistical analysis. Categorical measurements were reported as

number and percentage. Quantitative measurements were reported as the mean ± standard deviation (sd). Kolmogorov-Smirnov test was used to show the normal distribution of quantitative measurements. Chi square test was used to compare categorical measures and frequency of thyroid dysfunction between the groups. T test or Mann Whitney U tests were used for comparison of metabolic syndrome components and thyroid hormone concentrations between the two groups. Correlation coefficient was used for to analyse the degree of association between two variables (Pearson correlation coefficient (r) with p-value and 95% CI for r.). Log transformation was used for variables that were not normally distributed. An odds ratio was used to analyse the degree of association between the frequency of thyroid dysfunction and metabolic syndrome. The probability of making a Type I error (alpha, significance) is 0.05 in all tests.

Results:

The characteristics of the study subjects are summarized in Table 1. The mean age was 49.5 years (±10.1) for metabolic syndrome group, and 48.2 years (±13.0) for control group. There were 109 women and 36 men in metabolic syndrome group, 89 women and 25 men in control group. There was no statistical difference in the age and gender distrubition of the two groups (p=0.363 and 0.690, respectively). The mean TSH, FT3, FT4 levels were 3.39 (±6.60), 2.68 (±0.69), 1.31 (±0.39), respectively in patients with metabolic syndrome and 2.00 (±1.68), 3.05 (±0.67), 1.46 (±0.35), in those without the metabolic syndrome. The differences were statistically significant (p=0.006, <0.001, 0.001, respectively) (Table 1). Serum fasting insulin and fasting glucose levels were higher in study group and the difference was statistically significant (p<0.001) (Table 1).

	With metabolic syndrome N=145	Without metabolic syndrome N=114	p	Reference values
Age(years)	49.5±10.1	48.2±13.0	0.363	
Female sex N(%)	109 (75.1%)	89 (78%)	0.690	
BMI (kg/m^2)	35.8±7.1	23.4±3.6	<0.001	
Waist circumference	115.3±13.1	82.9±9.8	<0.001	Male<102 Female<88cm
Systolic blood pressure	153.2 ±19.6	107.6±12.6	<0.001	<130 mmHg
Diastolic blood pressure	89.1±9.7	67.7±10.8	<0.001	≤ 85 mmHg
Fasting glucose	162.6±79.8	90.0±8.0	<0.001	<110 mg/dl
HDL	44.5±11.7	52.4±10.2	<0.001	Male>40 Female>50 mg/dl
Triglyceride	202.3±117.6	97.8±51.2	<0.001	< 150 mg/dl
Fasting insulin	16.1±11.9	10.5±6.3	<0.001	(2.6-24.9 µU/ml)
TSH	3.39±6.60	2.00±1.68	0.006	(0.27-4.2 µIU/ml)
FT3	2.68±0.69	3.05±0.67	<0.001	(2.0-4.4 pg/ml)
FT4	1.31±0.39	1.46±0.35	0.001	(1.0-1.7 ng/dl)

Table 1: Clinical characteristics of the study subjects according to diagnosis of the metabolic syndrome

Fasting insulin levels were positively correlated with TSH and inversely correlated with FT3 and FT4 (r= 0.419, p<0.001; r=-0.166, p=0.007; r=-0.275, p<0.001, respectively). Fasting glucose levels were also positively correlated with TSH and inversely correlated with FT3 and FT4 (r=0.321, p<0.001; r=-0.195, p=0.018; r=-0.188, p=0.023, respectively) (Table 2). Frequency of total thyroid dysfunction in the study group was higher than that in the control goup (p=0.04) (Figure 1).

		Insulin	Fasting glucose
TSH	r	0.419	0.321
	p	<0.001	<0.001
FT3	r	-0.166	-0.195
	p	0.007	0.018
FT4	r	-0.275	-0.188
	p	<0.001	0.023

Table 2: Correlation of thyroid function tests with insulin and fasting glucose levels

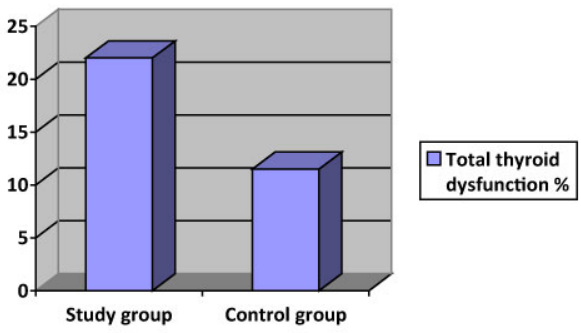

Figure 1: Comparison of the groups according to the frequency of total thyroid dysfunctions

In metabolic syndrome group; hypothyroidism, subclinical hypothyroidism, hyperthyroidism, subclinical hyperthyroidism and euthyroidism were found in 4.1%, 14.4%, 0%, 3.4%, 77.9% of patients, respectively while they were found in 1.7%, 4.3%, 1.7%, 3.5%, 88.5% of patients without metabolic syndrome. Frequency of subclinical hypothyroidism was higher in patients with metabolic syndrome. There was statistically significant difference between the groups (p=0.01) (Figure 2). Moreover, frequency of euthyroid patients was lower in the study group (p=0.038) (Table 3). There was an association between the thyroid dysfunction and metabolic syndrome (OR 2.2, Cl 95% 1,09 to 4,42, p<0.02).

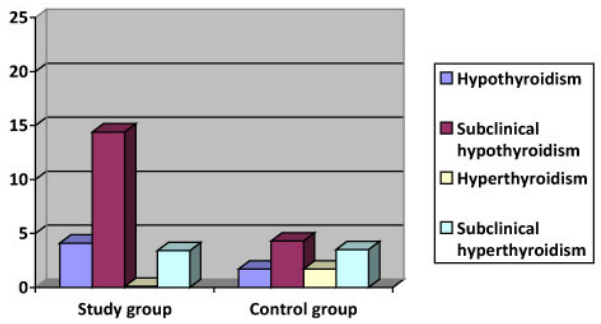

Figure 2: Comparison of the groups according to the frequency of thyroid dysfunctions

	Total	With metabolic syndrome N=145	Without metabolic syndrome N=114	p
Total Thyroid dysfunction N(%)	45 (17.3%)	32 (22%)	13(11.5%)	0.04
Hypothyroidism N(%)	8 (3%)	6 (4.1%)	2 (1.7%)	0.45
Subclinical hypothyroidism N(%)	26 (10%)	21 (14.4%)	5 (4.3%)	0.01
Hyperthyroidism N(%)	2 (0.8%)	0 (0%)	2 (1.7%)	0.39
Subclinical hyperthyroidism N(%)	9 (3.4%)	5(3.4%)	4 (3.5%)	0.76
Euthyroidism N(%)	214 (82.6%)	113 (77.9%)	101 (88.5%)	0.038

Table 3: Frequency of thyroid dysfunctions in the study and control groups

Discussion

Metabolic syndrome is a common chronic metabolic disorder in this region of our country. High prevalence of this metabolic disorder can be due to genetic factors, dietary habits and social life of Turkish people. In Özsahin et al. study, they found that the prevalence of the metabolic syndrome in a Turkish adult population as 33.4 % (39.1% for women and 23.7 % for men) in Adana, a southern province of Turkey [11].

In present study 13.1 % and 4.2 % of study subjects were found to have an high and low TSH levels, respectively. According to the result of this study, we have shown that frequency of thyroid dysfunction is high in our country.

In the current study we have found high frequency of total thyroid dysfunction in the study group. To our knowledge there is no any study which investigates all type of thyroid dysfunction in metabolic syndrome patients. Several studies investigated the association between thyroid dysfunction and metabolic syndrome. However, most of these studies investigated the association between metabolic syndrome and subclinical thyroid diseases and/or overt hypothyroidism [12-15].

On the other hand, Wang et al. analysed 9055 subjects with or without metabolic syndrome. They reported that the frequency of patients with normal thyroid status, subclinical hypothyroidism or subclinical hyperthyroidism were statistically similar in both groups. However, they did not analyse the patients with overt hypo-hyperthyroidism in their study [16]. In present study we have shown the prevalence of all types of thyroid dysfunction in patients with metabolic syndrome. To our knowledge this is the first study that investigates the frequency of all types of thyroid dysfunction in patients with metabolic syndrome.

Frequency of subclinical hypothyroidism is higher in patients with metabolic syndrome in our study. In accordance with this result, several studies have demonstrated a relationship between subclinical hypothyroidism and metabolic syndrome. The prevalence of subclinical hypothyroidism was also high in those studies [13,15,17,18]. Furthermore, we have found high TSH and low FT3, FT4 concentations in patients with metabolic syndrome compared to controls.

The major underlying pathophysiological process of the metabolic syndrome is insulin resistance [10]. We have found high insulin levels in patients with metabolic syndrome and shown an association between thyroid hormones and insulin levels. High TSH levels were positively correlated with serum fasting insulin levels. The study by Tuzcu, et al. have also shown the association between subclinical hypothyroidism and fasting hyperinsulinemia [19].

Thyroid disease is associated with atherosclerotic cardiovascular diseases. They are also associated with the risk factors associated with cardiovascular diseases such as dislipidemia, insulin resistance, abdominal obesity, hypercoagulability and inflammation [13,19,20]. Hyperthyroidism and also subclinical hyperthyroidism are associated with increased blood pressure, hearth rate and especially with atrial fibrillation [20,21]. Hypothyroidism and also subclinical hypothyroidism are associated with hypertension, dislipidemia, insulin resistance and low grade inflammation [22-24]. All these clinical findings which are found to be associated with thyroid dysfuncion can increase the high mortality and morbidity in patients with metabolic syndrome.

Our study did have some limitations. First we did not calculate HOMA index for insulin resistance. Secondly, we did not demonstrate the frequency of autoimmune thyroiditis in patients with metabolic syndrome. Thirdly, it would have been beneficial if the sample size had been larger.

In conclusion, patients with metabolic syndrome have an increased risk for thyroid dysfunction and, consequently, an increased risk for cardiovascular diseases. Deleterious effects of thyroid dysfunction on cardiovascular and metabolic function calls for a systematic approach to thyroid disease screening in patients with metabolic syndrome.

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