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Original Article

Relationship of metabolic syndrome and its components with thyroid dysfunction in Algerian patients

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ABSTRACT

Aims: The aim of this study is to evaluate the prevalence of the metabolic syndrome and its compounds in subjects with different thyroid status.
Materials and methods: A prospective cross-sectional study was conducted in the internal medicine department at El Okbi Hospital of Guelma (East of Algeria) from January 2014 to September 2015. Eighty six patients attending the specialist consultation for suspected thyroid disorders were included in the study. Gender; blood pressure; body mass index; and serum levels of fasting glucose, total cholesterol (TC), high-density-lipoprotein cholesterol (HDL-C), low-density-lipoprotein cholesterol, and triglyceride were compared between subjects with hypothyroidism, hyperthyroidism and euthyroidism.
Results and conclusion: Thyroid dysfunction was found in 59.3% (n = 42) patients, hypothyroidism (45.3%) was the major thyroid dysfunction followed by hyperthyroidism (14.0%). Overall, the prevalence of metabolic syndrome was 48.8% (n = 42). Subjects with hypothyroidism had significantly higher level of BMI, WC, TC, LDL-C, and higher prevalence of abdominal obesity (84.6%, $p < 0.01$) and hypertension (51.2%, $p < 0.05$). The hyperthyroid group had significantly lower level of TC, LDL-C and HDL-C but a higher level of SBP and UA. Furthermore, abdominal obesity, hypertension and low HDL-C level were the most common metabolic syndrome compounds found in the hyperthyroid group compared to the euthyroid group. We found a positive association between TSH level and the prevalence of the metabolic syndrome.

1. Introduction

The metabolic syndrome (MetS) is defined as a cluster of interrelated metabolic abnormalities, characterized by central obesity, hyperglycemia, hypertriglyceridemia, decreased high density lipoprotein-cholesterol (HDL), and elevated blood pressure (BP). People with MetS have an increased risk of cardiovascular disease, type 2 diabetes mellitus, and all-cause mortality. MetS requires 3 of the following 5 factors to make a diagnosis: increased waist circumference (WC), elevated triglycerides (TG), reduced HDL, elevated BP, and elevated fasting glucose (FG) [1,2].

Thyroid hormones have pleiotropic effects on lipid and glucose metabolism, blood pressure, and energy expenditure. Thyroid dysfunction is a risk factor of cardiovascular disease [3]. Recently, serum thyroid stimulating hormone (TSH) is also found to be associated with adverse changes of lipid metabolism as well [4,5]. The relationship between mild thyroid dysfunction and MetS traits has become a hot topic of discussion recently; they are the two most common endocrine disorders with a substantial overlap [6]. Both are associated with significant morbidity and mortality and thus impact substantially on health care [7,8].

In Algeria, socioeconomic, nutritional and epidemiological transition had contributes to the increase in different chronic diseases and abnormalities constituting metabolic syndrome [9]. The prevalence of metabolic syndrome in Algerian population was estimated at 20%, higher in women than men [10]. Furthermore, the frequency of thyroid diseases in Algeria continues to rise in recent years; they particularly affect adult female subjects [11,12]. There is no report studying thyroid dysfunction and metabolic syndrome association in Algerian population. The aim of this study is to evaluate the prevalence of the metabolic syndrome and its compounds in subjects with different thyroid status.

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2. Materials and methods

2.1. Population and study design

This cross-sectional study was conducted in the internal medicine department at El Okbi Hospital of Guelma (East of Algeria) from January 2014 to September 2015. Eighty six patients attending the specialist consultation for suspected thyroid disorders were included in the study. A structured questionnaire was filled out by each patient, which details: age, sex, height, weight, blood pressure, personnel and family medical history, clinical findings and laboratory results. Written informed consent was obtained from each patient after full explanation of the purpose and nature of all procedures used.

2.2. Clinical and biological measurements

Fasting blood samples (venous blood samples taken after overnight fast of a minimum of 8 h) were collected; Serum glucose, total cholesterol (TC), triglyceride (TG), high-density lipoprotein cholesterol (HDL-C), albumin, total serum proteins, urea, creatinine, uric acid, calcium, phosphorus, iron, magnesium, liver transaminases, creatine phosphokinase (CPK), lactate deshydrogenase (LDH), alkaline phosphatase (ALP) were measured using an clinical chemistry autoanalyzer (XL 200 – Erba diagnostics Mannheim), complete blood count, including hemoglobin (Hb), haematocrite (Hct), red blood cells, white blood cells and platelets, using an hematology coulter (Diatron Abacus). Ferritin (Ferr), serum free triiodothyronine (FT3), free thyroxine (FT4), thyroid stimulating hormone (TSH), anti-thyroid peroxidase antibody (ATPO Ab) and anti-thyroglobulin antibody (ATG Ab) were measured by using fluorescent immunoassay (VIDAS, biomeriux SA, France). Reference range for TSH was 0.25–5 mIU/L, FT3 (4.0–8.3 pmol/L), FT4 (9.0–20.0 pmol/L) anti-TPO (0–8 UI/ml) and anti-TG (0–18 UI/ml). All blood samples were analyzed in the laboratory of Medical Biochemistry, Ibn Zohr Public Hospital, Guelma, Algeria.

2.3. Definitions

Metabolic syndrome (MetS) was diagnosed by the modified National Cholesterol Education Program-Adult Treatment Panel-III (NCEP-ATPIII) criteria [13], which requires 3 or more of the following parameters: Elevated waist circumference (WC) >102 cm for men and >88 cm for women, hypertriglyceridemia (TG ≥1.7 mmol/L); low HDL cholesterol (HDL-C <1.03 mmol/L for men and <1.30 mmol/L for women); elevated blood pressure (systolic blood pressure ≥130 mmHg and/or diastolic blood pressure ≥85 mmHg or current use of antihypertensive drugs); impaired fasting glucose (fasting plasma glucose ≥5.6 mmol/L).

Thyroid function subgroups were determined as following; patients were said to be euthyroid if all thyroid hormone levels fell within reference range. Hypothyroidism was defined as TSH >5. Hyperthyroidism was defined as TSH <0.25 mIU/L.

2.4. Data analysis

Continuous variables are expressed as means ± standard deviation (SD); and categorical variables as frequencies and percentages. Using the euthyroid group as reference, the differences in baseline characteristics were tested using the Student's *t*-test for continuous data and Chi-square test for categorical data at 95% confidence interval. Pearson correlation coefficients were calculated to find relationship between the components of metabolic syndrome and thyroid profile parameters at 95% confidence interval. All statistical analyses were performed with the SPSS 20.0 (SPSS, Chicago, IL) statistical package for Windows. A two-tailed *P* value of less than 0.05 was considered to be statistically significant.

2.5. Ethics

The study was carried out in accordance with the ethical principles for medical research involving human subjects. The participants gave their free informed consent (verbally when it was not possible otherwise, e.g. in the case of illiteracy). Data was analyzed anonymously.

3. Results

The baseline characteristics of the population have been displayed in Table 1. Among the eighty six patients enrolled in this study, 18.6% ($n = 16$) were males and 81.4% ($n = 70$) were females. The mean age was 52.3 ± 15.3 years, ranging between 17 and 81 years. Height, weight, body mass index (BMI), waist circumference, systolic BP and diastolic BP were 161.1 ± 7.4 cm, 73.3 ± 8 kg, 28.7 ± 4.3 kg/m2, 94.5 ± 9.2 cm, 135.5 ± 30.2 mmHg and 81.5 ± 13 mmHg respectively. Levels of thyroid function test; FT3, FT4 and TSH were, 5.8 ± 1.0 pmol/L, 14.6 ± 2.9 pmol/L and 12.69 ± 3.4 mIU/L respectively.

Thyroid dysfunction was found in 59.3% ($n = 42$) patients, hypothyroidism (45.3%) was the major thyroid dysfunction followed by hyperthyroidism (14.0%). Prevalence of thyroid

Table 1
Baseline characteristics of the study population.

Characteristic (n = 86)	Mean ± SD or%
Gender (male/female)	16/70
Age (years)	52.3 ± 15.3
BMI, kg/m2	28.7 ± 4.3
WC, cm	94.5 ± 9.2
SBP, mmHg	135.5 ± 30.2
DBP, mmHg	81.5 ± 13
DM (%)	31.4
HTN (%)	39.5
TD (%)	59.3
MetS (%)	48.8
FHTD (%)	19.88
TSH	12.69 ± 3.4
FT3	5.8 ± 1.0
FT4	14.6 ± 2.9
ATPO Ab	167.9 ± 56.1
ATG Ab	240.1± 93.2
FBS (mmol/L)	6.4 ± 1.8
Cr (μmol/L)	77.4 ± 17.1
UA (μmol/L)	267.1 ±101.9
Urea (mmol/L)	4.8 ± 1.5
Alb (g/L)	43.1 ± 5.1
Hct (%)	38.4 ± 4.8
AST (UI/L)	27.4 ± 18.1
ALT (UI/L)	20.5 ± 12.3
ALP (UI/L)	101.6 ± 70.2
LDH (UI/L)	515.6 ± 156.9
CPK (UI/L)	153.1 ± 48.2
Ferritine (ng/ml)	73.4 ± 32.2
TC (mmol/l)	4.6 ± 1.6
TG (mmol/L)	1.7 ± 0.9
LDL-C (mmol/L)	3.1 ± 1.5
HDL-C (mmol/L)	1.1 ± 0.3

Alb = albumin, ALP = alkaline phosphatase, ALT = alanine aminotransferase, AST = aspartate aminotransferase, ATG Ab = anti-thyroglobulin antibody, ATPO Ab = anti-thyroperoxidase antibody, BMI = body mass index, CPK = creatine phosphokinase, Cr = creatinine, DM = diabetes mellitus; DBP = diastolic blood pressure, FBS = fasting blood sugar, FHTD = Family history of thyroid disease, FT3 = free triiodothyronine, FT4 = free thyroxine, *Hct* = hematocrit, HDL-C = high-density lipoprotein cholesterol, HTN = hypertension, LDH = lactate deshydrogenase, LDL-C = low-density lipoprotein cholesterol, MetS = metabolic syndrome, SBP = systolic blood pressure, TC = total cholesterol, TD = Thyroid dysfunction, TG = triglycerides, TSH = thyroid stimulation hormone, UA = uric acid, WC = waist circumference.

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