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Health Problems Accompanying Hypothyroidism in Patients in Ecuador

Ekvador'daki Hastalarda Hipotiroidi ile Birlikte Görülen Sağlık Sorunları

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Abstract

Purpose: The thyroid gland regulates a range of physiological functions through its hormonal secretions and multiple metabolic dysfunctions can arise from its functional anomalies. In this paper, the correlation between hypothyroidism (HT) and other diseases with particular emphasis on vascular risks have been studied.

Materials and Methods: Out of 11,520 adult patients who received medical care in external consultation of a public clinic of the Ecuadorian Institute of Social Security and in the Private Unit of Prevention Neuro-endocrine-vascular of Quito (Neurosciences Institute), 645 patients diagnosed with HT were studied.

Results: As compared to the general population, there was a significantly higher frequency of the following diseases among HT patients: dyslipidemia (67.0% vs. 1.4%), arterial hypertension (36.0% vs. 9.3%), obesity (35.0% vs. 24.3%), and hyperglycemia (18.0% vs. 3.4%). HT patients also exhibited various health hazards like cardiomegaly (18%), stroke (17%), and acute myocardial infarction (9%). Primary HT exhibits an incidence index with higher occurrences in the women (75.0%).

Conclusion: This study proposes, to this Hospital and the Ecuadorian Government, the implementation of greater effort in the diagnosis and research of root causes of HT in favor of prevention, and not just the control of co-morbidities, with the aim of enhancing the quality of life and prognosis for patients.

Keywords: Hypothyroidism, vascular risks, dyslipidemia, arterial hypertension, obesity, hyperglycemia

Özet

Amaç: Tiroid bezi hormonal sekresyonlarla çeşitli fizyolojik fonksiyonları düzenler ve fonksiyonel anomalilerinden çoklu metabolik fonksiyon bozuklukları ortaya çıkabilir. Bu yazıda, hipotirodizim (HT) ile diğer hastalıklar -özellikle vasküler riskler üzerine odaklanılarak- arasındaki korelasyon çalışılmıştır.

Gereç ve Yöntemler: Ekvador Sosyal Güvenlik Enstitüsü kamu kliniği ve Quito (Nörobilim Enstitüsü) Nöro-endokrin-vasküler Önleme Özel Biriminde dışardan konsülte edilerek tıbbi bakım alan 11.520 erişkin hasta arasından HT tanısı alan 645 hasta çalışmaya alınmıştır.

Bulgular: Genel popülasyona kıyasla, HT hastalarında aşağıdaki hastalıkların görülme sıklığı anlamlı şekilde daha yüksektir: dislipidemi (%67,0'a karşı %1,4), arteriyel hipertansiyon (%36,0'a karşı %9,3), obezite (%35,0'a karşı %24,3) ve hiperglisemi (%18,0'a karşı %3,4). HT hastalarında ayrıca kardiyomegali (%18), inme (%17) ve akut miyokard infarktüsü (%9) gibi çeşitli sağlık riskleri de görülmüştür. Primer HT, kadınlarda daha yüksek oranlarda insidans indeksi sergilemektedir (%75,0).

Sonuç: Bu çalışma, bu hastaneye ve Ekvador hükümetine, hastaların yaşam kalitesini ve prognozunu iyileştirmek amacıyla yalnızca eşlik eden hastalıkların kontrolünü değil, HT'nin önlenmesi için temel nedenlerinin teşhisi ve araştırılmasına yönelik daha fazla çaba gösterilmesini önermektedir.

Anahtar kelimeler: Hipotiroidizm, vasküler riskler, dislipidemi, arteriyel hipertansiyon, obezite, hiperglisemi

Introduction

The thyroid gland hormonally regulates a broad spectrum of metabolic functions, and alterations in the thyroid gland are associated with pathologies that have a high prevalence in the population worldwide (1). Morbidities such as cardiovascular risks, lipid profile alteration, and obesity are found to be much higher in patients with clinical HT (2–5). Even an association of HT with diabetes mellitus has been reported (6,7). A complete removal of the thyroid gland leads to accelerated atherosclerosis in rats, while humans commonly develop hypertension and dyslipidemia after thyroidectomy (8,9). The focus of most medical practices on the unilateral management of metabolic syndromes such as hypertension, dyslipidemia, and hyperglycemia, without a thorough investigation of the

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underlying pathogenic cause, seems to lead to an under-diagnosis of HT (10–14). The present study focuses on a comprehensive analysis of diseases accompanied and perhaps caused by a dysfunctional thyroid gland.

Methods

This study was carried out in two hospitals in Quito (Ecuador), an area that has low levels of natural iodine in the environment that drastically increases the incidence of HT (15,16). The percentages of different metabolic/vascular diseases were stratified by gender and age.

Totally, 11,520 adult patients were analyzed over a period of seven years at the Carlos Andrade Marín Hospital of the Institute of Social Security and at the Private Unit of Prevention Neuro-endocrine-vascular of Quito (Neurosciences Institute).

HT was confirmed with thyrotropin (TSH) and free thyroxine (FT4) measurement with Electrochemiluminescence Immunoassay (ECLIA) using ECLusys FT4 and TSH Kits (Roche Diagnostics GmbH, Mannheim, Germany). The following values of the thyroid hormones for adults were used as a baseline for indexing health status: FT4, 0.8-1.6 ng/dL; TSH, 0.2-4.5 μU/mL. The incidences of elevated TSH and low FT4 levels were considered an indication of HT.

The coincidences of dyslipidemia, hypertension, obesity, hyperglycemia, cardiomegaly, cardiovascular disease, and myocardial infarction, along with HT were determined. These data were stratified by gender and ranged groups of ten years for age, from 20 to 89 years old.

Obesity was defined as a body mass index (BMI) equal to or greater than 30 kg/m^2. Blood pressure was measured using a manual sphygmomanometer to confirm the presence of hypertension (defined as systolic pressure higher than 140 mmHg or a diastolic pressure higher than 90-99 mmHg). Pre-prandial laboratory tests were done for glucose, lipid profile, uric acid, and serum electrolytes. A baseline fasting blood glucose concentration of ≥7 mmol/L was considered as an indicator of hyperglycemia. Dyslipidemia was determined by an incidence of higher serum levels of total cholesterol, triglycerides, and LDL recorded at greater than the 90th percentile, and lower levels of HDL below the 10th percentile. Depending on the presence of symptoms, nuclear magnetic resonance (NMR) was performed with a Siemens Magnetom Symphony 1.5T®, in axial, coronal, and sagittal planes, to detect cerebrovascular diseases. Teleradiographies (X-ray images) for detecting cardiomegaly, were all taken in the posteroanterior position and were recorded, either with the Shimadzu Flexavision F3 package, using an X-ray tube (400 KHU) in the initial phases of the study, or later with a Siemens Vertix digital radiography system, with X-ray tube assembly Optilix 150/30/50 C.

Additionally, the medical history of these patients was studied to determine the incidence of neuropathy, depression, bradypsychia, gout disease, constipation, insomnia, and endocrine anemia. The patients diagnosed with HT were prescribed replacement therapy with synthetic thyroxine (T4) with initial doses being carefully selected on the basis of the patient's weight, age, and accompanying medical conditions.

Statistical analysis

The statistical evaluation of the data was performed by Student's t-test and a chi-Square test, using a significance level of 0.05. This study was conducted with the informed consent of the patients and their families and with meticulous care taken to keep patient information confidential.

Results

Prevalence of HT

The sample of patients with a clinical diagnosis of HT was made up of 645 people, representing the 5.60% of all patients registered with a higher incidence among women (7.50% vs. 3.18%; p<0.05). Chronic autoimmune thyroiditis was the most common underlying etiology of HT (65%) followed by the environmental iodine deficiency (22%), and drug-induced inhibition of production of thyroid hormones (1%).

Relationship with other diseases

The HT patients presented with significantly higher rates (p<0.05) of dyslipidemia, arterial hypertension, obesity, and hyperglycemia. Dyslipidemia was observed in 67.0% of patients compared to 1.4% of the total Ecuadorian population (17). Thirty-six percent of the HT patients exhibited arterial hypertension, compared to 9.3% in the general population (18), and 35.0% exhibited a higher obesity ratio, compared to 24.3% (19). Hyperglycemia was recorded in 18% vs. 3.4% in the general population (20).

The HT patients presented with various cardiovascular diseases: cardiomegaly (18%), stroke (17%), and acute myocardial infarction (9%) (Table 1). Sixty-two percent of the HT patients demonstrated all three symptoms: dyslipidemia, hyperglycemia, and hypertension.

The patients were stratified in 10-year exclusive ranges beginning from the age of 20. The details of patients depicting stratification based on age intervals are presented in Tables 2 and 3. Dyslipidemia, high blood pressure and hyperglycemia, and obesity were more common in the 50-79 years, 60-69 years, and 70-79 years groups, respectively.

Other co-morbidities associated with HT in patients were as follows: neuropathy (23%), depression (64%), bradypsychia (13%), gout disease (11%), constipation (9%), insomnia (7%), and endocrine anemia (5%). After substitution treatment with synthetic T4, the TSH levels in all HT patients increased to >0.2 μU/mL.

Table 1. The demographics of the HT patients with other metabolic-vascular diseases, classified by gender (male/female), out of 11520 adult patients.

	Number of patients			
	Male	Female	Total	Percentage
Dyslipidemia	85	347	432	67
Arterial hypertension	49	183	232	36
Obesity	62	163	225	35
Hyperglycemia	43	73	116	18
Cardiomegaly	5	12	17	17
Stroke	9	8	17	17
Acute myocardial infarction	6	3	9	9

Table 2. The frequency and percentage of HT patients (with TSH >4.5 µU/mL and FT4 <0.8 ng/dL, or FT3 >4.3 pg/mL), classified by gender (male/female) and age, out of 11520 adult patients who received attention.

	Percentage of HT patients					
	Male		Female		Total	
Age	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
20-29	35	0,3	115	1	150	1,3
30-39	115	1	115	1	230	2
40-49	207	1,8	691	6	899	7,8
50-59	495	4,3	2074	18	2569	22,3
60-69	991	8,6	3087	26,8	4078	35,4
70-79	852	7,4	2419	21	3272	28,4
80-89	92	0,8	230	2	323	2,8
Total	2788	24,2	8732	75,8	11520	100

Table 3. The percentage of HT patients suffering arterial hypertension, hyperglycemia, obesity, and dyslipidemia classified by gender (male/female) and age, out of 645 adult patients (92 patients per age).

	Percentage of HT patients suffering different diseases											
	Arterial hypertension			Hyperglycemia			Obesity			Dyslipidemia		
Age	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
20-29	0.0	0.8	0.8	0.0	0.0	0.0	0.0	3.5	3.5	0.4	1.0	1.4
30-39	0.0	2.6	2.6	0.0	1.2	1.2	3.5	13.3	16.8	0.9	1.0	1.9
40-49	0.0	4.3	4.3	1.2	1.2	2.4	0.0	13.3	13.3	1.8	6.0	7.8
50-59	2.6	9.5	12.1	1.2	8.6	9.8	0.0	14.0	14.0	4.3	18.0	22.3
60-69	9.9	29.3	39.2	13.0	37.0	50.0	7.5	14.0	21.5	8.6	24.6	33.2
70-79	2.6	33.6	36.2	4.6	29.0	33.6	4.4	20.3	24.7	7.4	21.0	28.4
80-89	0.8	4.0	4.8	1.5	1.5	3.0	0.0	6.2	6.2	3.0	2.0	5.0
Total	15.9	84.1	100.0	21.5	78.5	100.0	15.4	84.6	100.0	26.4	73.6	100.0

Discussion

An analysis of accompanying health problems in the HT patients in a population of the Andes (Quito, Ecuador) was made in this longitudinal study. In this area, owing to a low level of environmental iodine (EI), the population exhibits a high incidence of HT (5.6%), with the incidence being two times higher in women than in men. The higher incidence of HT in women may be due to a decrease in the estrogenic vascular protection post 45 years of age (21). However, an age range over 80 years did not show any difference between genders; this may be due to the underlying autoimmune mechanisms for most types of thyroid diseases (3).

A possible explanation for the correlation between HT and dyslipidemia is that HT causes alterations in the composition and transport of lipoproteins, as well as the lipids synthesis and metabolism (2–4). HT is also associated with hypercholesterolemia, due to an increase in the level of total and LDL (low-density lipoprotein) cholesterol, ApoB (apolipoprotein B), and possibly triglycerides concentration (22).

As depicted by the results, higher rates of hypertension were found among HT patients than in the general population. In fact, a direct relation between systolic (but not diastolic) blood pressure and the level of triiodothyronine in the blood (23) is documented in HT patients in other studies.

In this study, HT patients showed a higher rate of obesity than the general population. The deficiency of thyroid hormones, known modulators of adaptive thermogenesis, may lead to an increase in the body weight due to the growth of mucin deposits and water and salt retention (24). However, it is still unclear that which is the cause and which is the effect, since it also known that extreme obesity leads to an increase in TSH due to an abnormality in the hypothalamic-pituitary-thyroid axis (5).

The higher prevalence of hyperglycemia among HT patients could be because both diseases share susceptible causal genes and coexist with other organ-specific autoimmune diseases. Therefore, a thyroidal dysfunction should compromise metabolic control, compounding the risk of cardiovascular diseases in diabetic patients (25).

A high prevalence of cardiovascular diseases in HT patients is consistent with the fact that one of the most characteristic symptoms to detect HT is related to the effect of the thyroid hormone on the cardiovascular system (26) and stroke (27). This effect of HT on the cardiovascular system is related to cardiac output, cardiac contractility, myocardial oxygen consumption, variation in blood pressure, and systemic vascular resistance (28), and may even induce atrial fibrillation.

A timely management of HT could lead to an improved quality of life in the patients suffering from different related diseases like

stroke and accelerated atherosclerosis. Improving myocardial contractility could thus lead to the vascular recovery and reduce the risk of acute myocardial infarction. Dyslipidemia could also be controlled with the management of HT, boosting this hypertension cure and reducing the risk of other co-morbidities (1,18). A major problem with the diagnosis of HT is that it is often not obvious and requires a high degree of suspicion. To make a correct diagnosis the determination of TSH is required since there are no specific clinical manifestations or pathognomonic signs associated with this disorder. This determination is necessary when patients show symptoms suggestive of HT, such as constipation, fatigue, dry skin, hoarseness, muscle weakness, etc.

The high prevalence of HT in Latin America, mostly under-diagnosed, must prompt both government and private health management institutions to undertake all types of training campaigns for their medical personnel to implement new clinical measures. It should involve third generation laboratory tests, as in the case of the "Equinoccial" scale used in the clinical phase of this study. Global health policies are generally directed toward the control of preventable risk factors, and not their elimination. A significant advancement in the neuroendocrine-metabolic pathogenic research is required, which could be more effective in reducing vascular morbidity-mortalities and disabilities arising from cerebral infarctions. An improved coverage of the control of hypertension, hyperglycemia, dyslipidemia, and smoking is not enough; efforts need to be made to reduce stroke-induced mortality for which the socioeconomic cost is among the highest of all chronic diseases (29).

In conclusion, this study proposes, to this Hospital and the Ecuadorian Government, the implementation of greater effort in the diagnosis and research of root causes of HT in favor of prevention, and not just the control of co-morbidities, with the aim of enhancing the quality of life and prognosis for patients.

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