

Thyroid Function Tests of Type 2 Diabetic Patients in Baghdad Governorate (El-Mahmoodiya District)

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Abstract

Background: Diabetes mellitus type 2 and thyroid disorders are the two most common endocrine disorders encountered in clinical practice, and associations between both conditions have long been reported.

Objectives: To study thyroid function tests in our type 2 diabetic patients.

Methods: The study was conducted at El-Mahmoodiya general hospital in Baghdad governorate from March to June 2013 where 30 diabetic type 2 patients included randomly in the study and another 30 healthy non diabetic were included as a control group. The two groups were sex and age matched. Thyroid function tests were assessed for both groups.

Results: Abnormal thyroid function tests (T3, T4, and TSH) are significantly higher in prevalence among the diabetic than control group, with hypothyroidism being the mostly encountered abnormality.

Conclusion: A systematic approach to thyroid testing in diabetic type 2 patients is favorable.

فحوص وظائف الغدة الدرقية في مرضى السكر النوع الثاني في محافظة بغداد (منطقة المحمودية)

الخلاصة

الخلفية: داء السكر واضطرابات الغدة الدرقية هما من اضطرابات الغدد الصماء الأكثر حضورا خلال العمل السريري. كما ان الترابط بين الحالتين بحث منذ مدة طويلة.

الاهداف: دراسة وظائف الغدة الدرقية في مرضانا المصابين بداء السكر النوع الثاني.

الطرائق: أنجزت الدراسة في مستشفى المحمودية العام في محافظة بغداد خلال الفترة من اذار لغاية حزيران ٢٠١٣ حيث ادخل ثلاثون مريض مصابين بالنوع الثاني داء السكري بشكل عشوائي كما ادخلت مجموعة اخرى من ٣٠ شخص من غير المصابين بداء السكر و السليمين كمجموعة سيطرة للمقارنة. المجموعتان كانتا متماثلتين من ناحية العمر والجنس. وظائف الغدة الدرقية قيمت لكلى المجموعتين.

النتائج: اضطرابات فحوص وظائف الغدة الدرقية كانت أكثر مشاهدة وبشكل مؤثر من الناحية الاحصائية بين مجموعة المصابين بداء السكر النوع الثاني بالمقارنة مع مجموعة غير المصابين.

الاستنتاجات: من الأفضل العمل بشكل نظامي على فحص وظائف الغدة الدرقية في مرض السكري.

Introduction

Diabetes mellitus (DM) is one of the most common non-communicable diseases globally [1]. Type 2 diabetes is a

heterogeneous disorder. Three basic metabolic defects characterize the disease: insulin resistance, an insulin secretory defect that is not autoimmune-mediated, and an increase

in glucose production by the liver [2]. Type 2 diabetes comprises 90% of people with diabetes around the world [3].

Thyroid disorders are widely common with variable prevalence among the different populations [4]. In the Colorado thyroid Disease prevalence study involving (25862) participants attending a state health fair, 9.5% of the studied population were found to have an elevated TSH, while 2.2% had a low TSH [5]. Diabetes and thyroid disorders have been shown to mutually influence each other and associations between both conditions have long been reported [6]. Several reports documented a higher than normal prevalence of thyroid dysfunction in the diabetic population. Particularly, Perros *et al.* demonstrated an overall prevalence of 13.4% of thyroid diseases in diabetics with the highest prevalence in type 1 female diabetics (31.4%) and lowest prevalence in type 2 male diabetics (6.9%) [7].

The relationship between thyroid disorders and diabetes mellitus is characterized by a complex interdependent interaction [8]. Thyroid hormones are insulin antagonists, both insulin and thyroid hormones are involved in cellular metabolism and excess and deficit of any can result in functional derangement of the other [9]. Thyroid disorders, including both hypo- and hyper have been associated with insulin resistance due to various mechanisms [10]. Thyroid hormones exert profound effects in the regulation of glucose homeostasis. These effects include modifications of circulating insulin levels and counter-regulatory hormones, intestinal absorption, hepatic production and peripheral tissues (fat and muscle) uptake of glucose . It has long been known that thyroid hormones act differentially in liver, skeletal muscle and adipose

tissue – the main targets of insulin action [11]. While thyroid hormones oppose the action of insulin and stimulate hepatic gluconeogenesis and glycogenolysis [12] they up-regulate the expression of genes such as GLUT-4 and phosphoglycerate kinase, involved in glucose transport and glycolysis respectively, thus acting synergistically with insulin in facilitating glucose disposal and utilization in peripheral tissues [13].

Altered thyroid hormones have been described in patients with diabetes especially those with poor glycemic control. In diabetic patients, the nocturnal TSH peak is blunted or abolished, and the TSH response to TRH is impaired [14]. Reduced T3 levels have been observed in uncontrolled diabetic patients. This “low T3 state” could be explained by impairment in peripheral conversion of T4 to T3 that normalizes with improvement in glycemic control [15]. Higher levels of circulating insulin associated with insulin resistance have shown a proliferative effect on thyroid tissue resulting in larger thyroid size with increased formation of nodules [16].

It has been shown, both in euthyroid non-diabetic [17] and diabetic adults [18] that small variations in TSH at different levels of insulin sensitivity might exert a marked effect on lipid levels. The interaction between insulin resistance and lower thyroid function might be a key determinant for a more atherogenic lipid profile in these populations. Furthermore, an increased risk of nephropathy was shown in type 2 diabetic patients with subclinical hypothyroidism [19]. As for retinopathy, Yang *et al* demonstrated recently that diabetic patients with subclinical hypothyroidism have more severe retinopathy than euthyroid patients with diabetes [20].

The aim of this control case study is to determine the features of thyroid function tests in our type 2 diabetic patients.

Methods

This study was carried out at El Mahmoodiya General Hospital in Baghdad Governorate from March to June 2013 .

Thirty diabetic type 2 patients were included randomly in the study and thirty other healthy non diabetic persons from those who have visited the hospital for check up were selected in a way to have a sex and age control group. The diagnosis or exclusion of DM was according to the American diabetic association [21]. Type 2 DM were distinguished in the case group based on clinical circumstances [22]. None of the diabetic patients or

persons within the control group were known to have a thyroid disease or taking medications that might affect thyroid function. All the diabetic patients and persons in the control group were subjected to detailed history, physical examination, and were investigated for (FBG, renal function tests, liver function tests, lipid profile, CBP and electrocardiography).

Total triiodothyronine T3, total thyroxine T4 , and thyroid stimulating hormone TSH were determined for all the diabetic and control group by the two site - immunoenzymometric assay. The values for thyroid function test which considered normal were as follow ; T3 (0.79 – 1.58) ng/ml , T4 (4.9 – 11) µg/dl, and TSH (0.38 – 4.31) mIU/ml. Thyroid function tests results were interpreted as illustrated in the table -1- below [23, 24] .

Table 1 thyroid function tests results and their potential meaning

TSH	T4	T3	interpretation
High	Normal	Normal	(subclinical) hypothyroidism
High	Low	Low or normal	clinical Hypothyroidism
Low	Normal	Normal	(subclinical) hyperthyroidism
Low	High or normal	High or normal	Clinical Hyperthyroidism
normal	normal	low	Low T3 syndrome

The Statistical Analysis System-SAS (2010) was used to effect of difference factors (groups) in study parameters [25]. Least significant difference-LSD test was used to compare between means and chi-square test was used to compare between percentages in this study and p value <0.05 considered significant.

Results

30 diabetic type 2 patients were included in the study, and 30 non diabetic were included also as a control group .Table -2- shows the mean ages comparison and gender comparison between the two groups. The two groups were matched with regard to both age and gender.

Table -3- illustrates the mean levels and standard deviations of thyroid

function tests (T3, T4, and TSH) in the two groups .

Table -4- shows the number and percentage of those who were found to have abnormal thyroid function tests in each group. 6 of the 30 diabetics i.e (20%) have abnormal thyroid function

tests versus 1 of the 30 (3.33%) in the control group (the difference is statistically significant with p value < 0.01) .

Table -5- demonstrates the types of abnormal thyroid function tests in the diabetic group .

Table 2 Gender and age distribution of diabetic type 2 and control subjects.

Group	Gender	Number	Mean age $\pm$ SD (years)
Diabetic Total (30)	Male	14	53.00 $\pm$ 11.90
	Female	16	
Control Total (30)	Male	15	52.00 $\pm$ 11.20
	Female	15	

Table 3 Comparison between control and diabetic groups according to mean levels of thyroid function tests.

Group	Mean $\pm$ SD		
	T3ng/ml	T4 μ g/dl	TSH mIU/ml
control	1.0434 $\pm$ 0.157	7.260 $\pm$ 1.336	1.384 $\pm$ 0.994
diabetic	1.090 $\pm$ 0.399	7.033 $\pm$ 0.970	1.737 $\pm$ 1.274
LSD Value	0.083 NS	0.0454 *	0.187 *
P-value	0.736	0.036	0.0218
* (P<0.05), NS: Non-significant.			

Table 4 Number and percentage of those with abnormal thyroid function tests in both groups.

Group		Normal thyroid function tests	Abnormal thyroid Function tests	Total No.	Chi-square value
Diabetes	No.	24	6	30	10.25 **
	%	80.00	20.00	100 %	
Control	No.	29	1	30	12.04 **
	%	96.67	3.33	100 %	
** (P<0.01).					

Table 5 pattern of thyroid function tests in the diabetic group.

Thyroid function tests	number	percentage
Normal	24	80%
Clinical hypothyroidism	1	3.33%
Subclinical hypothyroidism	2	6.66%
Low T3 syndrome	2	6.66%
Subclinical hyperthyroidism	1	3.33%
total	30	100%

Discussion

In this case-control study, both the diabetic type 2 patients and control groups were matched in age and gender (as it is shown in table 2). Table (3) shows the means with standard deviations of T3, T4, and TSH in both groups. The mean level of T4 is lower in the diabetic group, while that of TSH is higher in the diabetic than control group.

Considering the number and percentage of those who have abnormal thyroid function tests in both groups (table 4), there is a statistically significant difference, as 6 of the 30 diabetic patients i.e (20%) have abnormal thyroid function tests versus one in the 30 control group (3.33%) . By this we agree with several other studies which revealed higher incidence of thyroid dysfunction in diabetic type 2 patients comparing to general population . A prevalence of 12.3% was reported among Greek diabetic type 2 patients [26] and 16% of Saudi patients with type 2 diabetes were found to have thyroid dysfunction [27]. In Jordan, a study reported that thyroid dysfunction was present in 12.5% of type 2 diabetic patients [28] , and an Indian study showed 28.75% of abnormal thyroid function tests among type 2 diabetic patients [29]. The

prevalence was 12.9% in a Kuwaiti study[30] .

Several studies [7 , 26 , and 30] have shown female gender as a predictive factor for development of abnormal thyroid function tests in diabetic type 2 patients, however we have not found this result, probably because of the smaller size of the number of patients.

Regarding the pattern of thyroid dysfunction (table 5) , from the total of six patients who have thyroid dysfunction in the diabetic group, (2 patients) have subclinical hypothyroidism, (1 patient) has clinical hypothyroidism , (2 patients) have low T3 syndrome, and (1 patient) has subclinical hyperthyroidism, so the pattern of dysfunction is toward hypothyroidism rather than hyperthyroidism. This comes in accordance with other studies like perros *et al* [7] , and AL Wazzan HT *et al* [30] studies which revealed higher incidence of subclinical hypothyroidism among all other patterns of thyroid dysfunction in diabetes mellitus type 2 . The only person in the control group who has abnormal thyroid function tests showed the pattern of subclinical hypothyroidism . Two of 6 (33.33%) of those with abnormal thyroid function tests in diabetic group of present study showed the pattern of

lowT3, normal T4, and TSH. This pattern goes with low T3 syndrome. low T3 syndrome is the most common pattern among patients with euthyroid sick syndrome in practice [31] . In Al Wazzan *et al* study, sick euthyroid syndrome constituted 15.7% of those with abnormal thyroid function in diabetic type 2 patients .

In conclusion ; the incidence of abnormal thyroid function tests in our type 2 diabetic patients is 20% with hypothyroidism being the mostly encountered. Despite the absence of definite guidelines regarding screening for thyroid dysfunction in diabetic patients, in the view of this incidence together with the mutual effect of the common two endocrinopathies on each other and the increased risk of complications in diabetic patients in the setting of abnormal thyroid dysfunction, a systematic approach to thyroid testing in diabetic patients is favorable .

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