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EVALUATION OF THYROID DYSFUNCTION AMONG TYPE II DIABETIC PATIENTS

*Vinu Vij *, Pallavi Chitnis, Vijay Kumar Gupta*

Department of Physiology, Pad. Dr D Y Patil Medical College and Hospital, Nerul, Navi Mumbai, India.

***Corresponding Author Email: vijvinuvij@gmail.com**

ABSTRACT

Background *– Diabetes mellitus (DM) and thyroid dysfunction are the two most common endocrinopathies seen in general population. Type II diabetes mellitus is commonly associated with altered thyroid function.* ***Aim*** *– The present study was done to study the prevalence of thyroid dysfunction in patients of Type II diabetes mellitus.* ***Materials and methods*** *– In the present study 80 type II diabetic subjects and 80 healthy non diabetic subjects were investigated for fasting plasma glucose (FPG), glycosylated haemoglobin (HbA1c), total tri-iodo-thyronine (T3), total thyroxine (T4), free tri-iodo-thyronine (FT3), free thyroxine (FT4) and thyroid stimulating hormone (TSH).* ***Result*** *– Out of the 80 type II diabetic subjects studied, 28.75% showed abnormal thyroid function (22.50% had hypothyroidism and 6.25% had hyperthyroidism) and 71.25% showed normal thyroid hormone level .* ***Conclusion*** *- The ability to diagnose and treat unsuspected hypothyroidism in type II diabetic patients may result in better control of the diabetic state, thereby greatly enhancing the quality of life. This study justifies the view that all type II diabetic patients should be screened for hypothyroidism.*

KEYWORDS

Diabetes mellitus, hypothyroidism, T3, T4, FT3, FT4, TSH.

INTRODUCTION

Diabetes Mellitus is the most common endocrinal disorder seen in clinical practice. The prevalence of diabetes mellitus in West is between 6-7.6 %. India has already become the “diabetes capital” of the world with over 3 crore affected patients. Between 1995 and 2025, there is predicted to be a 35% increase in the worldwide prevalence of diabetes. The rising number of people with diabetes will occur mainly in populations of developing countries, leading to more than 300 million people with diabetes globally by 2025[1].

Thyroid disorders are also very common in the general population and it is second only to diabetes mellitus as the most common condition to affect the endocrine system. As a result it is common for an individual to be affected by both thyroid diseases and diabetes. The first report showing the association between diabetes and thyroid dysfunction was published in 1979 [2, 3]. Since then a number of studies have estimated the prevalence of thyroid dysfunction among diabetes patients to be varying from 2.2 to 17 %, the most common disorder being subclinical hypothyroidism [4, 5]. However, few studies have also estimated much higher prevalence of thyroid dysfunction in diabetes i.e. 31 % and 46.5% respectively [6, 7].

Thyroid function tests are especially recommended in patients with clinical suspicion and / or unexplained changes in diabetic metabolic control or serum cholesterol and weight gain. The treatment of hypothyroidism helps better control of other associated conditions. The ability to diagnose and treat unsuspected hypothyroidism in these patients may greatly enhance the quality of life. Hence the need to detect such cases where hypothyroidism contributes to morbidity and

where it is the cause for poor control of the associated conditions [1].

MATERIALS AND METHOD

Patients' Data

This study was conducted at a tertiary care hospital in Mumbai from January 2010 to February 2010. Outpatients attending the outpatient department and inpatients admitted in the wards who were either previously or newly diagnosed diabetic were included in the study. The study population consisted a total of 80 Type II diabetic patients (40 males and 40 females) and 80 non diabetic subjects (40 males and 40 females) with mean age of 43.45 ± 3.18 and 41.77 ± 2.53 respectively. The non-diabetic volunteers without history of diabetes mellitus whose FPG was less than 110 mg /dl on two occasions were the control subjects. These volunteers included non-diabetic subjects who came in the hospital for routine check-ups as advised by their attending physicians. The controls were not on any drugs.

Study Design

Randomly selected diabetic patients were subjected to evaluation for thyroid function biochemically. The diagnosis of DM was based on the American Diabetes Association criteria for type II DM (fasting plasma glucose level higher than 126 mg/dl and/or glucose level exceeding 200 mg/dl at 2 hours in the 75 g oral glucose tolerance test).

Laboratory Data

Venous blood sample was withdrawn and assayed for thyroid function (T3, T4, FT3, FT4, and TSH) and for the glycaemic status (FPG, HbA1c).

The following guidelines for detection of thyroid dysfunction were considered –

1) Normal – when FT3, FT4, T3, T4 and TSH were within the normal range.

2) Primary hypothyroidism – when TSH is more than 5.2 µIU/L and FT3, FT4, T3, T4 is less than the normal value.

3) Primary hyperthyroidism - when TSH is less than 0.2 µIU/L and FT4, FT3, T3, T4 is more than the normal values.

4) Subclinical hypothyroidism – when TSH is more than 5.2 µIU/L and FT3, FT4, T3, T4 is within the normal range.

5) Subclinical hyperthyroidism – when TSH is less than 0.2 µIU/L and FT3, FT4, T3, T4 are within the normal range.

Statistical Analysis

All data was entered into Statistical Package for Social Sciences (SPSS 15.0 for windows) for analysis. The results were expressed as mean ± SD of each variable. The comparison between means was performed by student t test. P-value of 0.05 or less was interpreted as significant for the analysis.

RESULTS

Table 1 presents the sex and age distribution of diabetic and non - diabetic subjects. Both Type II diabetic and non-diabetic subjects included 40 males and 40 females with mean age of 43.45 ± 3.18 and 41.77 ± 2.53 respectively.

Table 1:Sex and age distribution of diabetic and non - diabetic subjects

Group	Sex	No	Mean age in years
Type II Diabetic Subjects (N=80)	Male Female	40 40	43.45 ± 3.18
Non Diabetic Subjects (N=80)	Male Female	40 40	41.77 ± 2.53

Table 2 shows the level of various laboratory parameters in diabetic and non-diabetic subjects. FPG and HbA1c were significantly higher in diabetic patients as compared to the non-diabetic subjects. The serum levels of T3, T4, FT3 and FT4 were significantly lower in diabetic subjects as compared to the non-diabetic subjects while level of serum TSH was significantly higher in diabetic subjects as compared to the non-diabetic subjects.

Table 2 : level of various laboratory parameters in diabetic and non-diabetic subjects

Parameters measured	Normal values	Type II DM (n = 80)	Non diabetic control group (n = 80)	P value
FPG	70-110mg/dl	160.95± 4.006	83.80± 4.821	0.000*
HbA1c	4.2 - 6.2 %	7.372 ± 0.195	5.18 ± 0.175	0.000*
Free T3	1.5-4.2 pg /ml	2.174 ± 0.053	3.00 ± 0.066	0.000*
Free T4	0.8-1.68 ng/dl	1.044 ± 0.049	1.243 ± 0.047	0.000*
T3	70-210 ng/dl	124.083 ± 7.266	154.141 ± 4.792	0.000*
T4	5.2-11.8 µg/dl	7.624 ± 0.261	8.465 ± 0.2105	0.000*
TSH	0.2-5.2 µIU/ml	7.6006 ± 1.276	2.883 ± 0.283	0.000*

p-value ≤0.05 –significant *

Table 3 shows the distribution of thyroid disorder according to the gender in type II diabetes mellitus and non-diabetic control subjects.

Table 3 : Type of thyroid disorders according to gender in type II diabetes mellitus and non- diabetic control group

Distribution Of Subjects According To Gender	Subclinical Hypothyroidism	Primary Hypothyroidism	Subclinical Hyperthyroidism	Primary Hyperthyroidism
Type II DM Male (N = 40)	3	2	0	2
Type II DM Female (N = 40)	8	5	0	3
Non Diabetic Male (N = 40)	1	0	0	0
Non Diabetic Female (N = 40)	2	0	0	0

Out of the 80 type II diabetic subjects studied, 28.75% showed abnormal thyroid function (22.50% had hypothyroidism and 6.25% had hyperthyroidism) and 71.25% showed normal thyroid hormone level.

The incidence of hypothyroidism was more in females as compared to the males in type II diabetes (Males 12.5 %, Females 32.50 %).
Hypothyroidism was present in 22.50% patients, of which 13.75% had subclinical hypothyroidism and 8.75% had primary hypothyroidism.

The results of the present study were in accordance with the reports of Suzuki *et al* [8],Smithson *et al*[9], Celani *et al*[10], Udiang *et al*[11], Perros P et al [12] and Gray RS,Borsey DQ et al [13] who in separate studies found altered thyroid hormone level (both low and high) in a diabetic patient.

DISCUSSION

Effects of Thyroid Hormones on Glucose Homeostasis

Thyroid hormones affect glucose metabolism via several mechanisms. Hyperthyroidism has long been recognized to promote hyperglycaemia [14]. During hyperthyroidism, the half-life of insulin is reduced most likely secondary to an increased rate of degradation and an enhanced release of biologically inactive insulin precursors [15, 16].

Endogenous production of glucose is also enhanced in hyperthyroidism via several mechanisms [17, 18].

It is well known that diabetic patients with hyperthyroidism experience worsening of their glycaemic control and thyrotoxicosis has been shown to precipitate diabetic ketoacidosis in subjects with diabetes [19, 20].

As for hypothyroidism, glucose metabolism is affected as well via several mechanisms. A reduced rate of liver glucose production is observed in hypothyroidism and accounts for the decrease in insulin requirement in hypothyroid diabetic patients [21].

A recent study involving subjects from a Chinese population found a higher TSH level in patients with metabolic syndrome compared to that in the non-metabolic syndrome group suggesting that subclinical hypothyroidism may be a risk factor for metabolic syndrome [22].

Uncontrolled hyperthyroidism in diabetic patients may trigger hyperglycaemic emergencies while recurrent hypoglycaemic episodes have been reported in diabetic patients with hypothyroidism. Furthermore, thyroid dysfunction may amplify cardiovascular disease risk in diabetic patients through inter-relationships with dyslipidaemia, insulin resistance and vascular endothelial dysfunction.

Effects of Diabetes Mellitus on Thyroid Hormones and Thyroid Diseases

Altered thyroid hormones have been described in patients with diabetes especially those with poor glycaemic control. In diabetic patients, the nocturnal TSH peak is blunted or abolished, and the TSH response to TRH is impaired [23]. 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 glycaemic control.

The abnormal thyroid hormone level may be the outcome of various medications that the diabetic patients were receiving. For example, it is known that insulin [24], an anabolic hormone enhances the level of FT4 while it suppresses the level of T3 by inhibiting hepatic conversion of T4 to T3. On the other hand some of the oral hypoglycaemic agents such as the phenylthioureas are known to suppress the level of FT4 and T4, while causing raised levels of TSH [25, 26].

CONCLUSION

The relationship between diabetes mellitus and thyroid disorders is characterized by a complex interdependent interaction. Furthermore, it seems that unidentified thyroid dysfunction could negatively impact diabetes and its complications. A higher frequency of retinopathy and nephropathy was observed in diabetic patients with subclinical hypothyroidism, and more severe retinopathy was noted [27, 28, 29]. Therefore, management of subclinical hypothyroidism in patients with diabetes may prove beneficial. We conclude that a systematic

approach to thyroid testing in diabetic subjects is desirable; particularly in those patients whose associated conditions are difficult to manage. The treatment of hypothyroidism helps in better control of other associated conditions. The ability to diagnose and treat unsuspected hypothyroidism in these patients may greatly enhance the quality of life. Hence the need to detect such cases where hypothyroidism contributes to morbidity and where it is the cause for poor control of the associated conditions.

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***Corresponding Author:**
Vinu Vij *
Department of Physiology,
Pad. Dr D Y Patil Medical College and Hospital,
Nerul, Navi Mumbai, India.
Email id – vijvinuvij@gmail.com