ORIGINAL ARTICLE

THYROID DYSFUNCTION IN PATIENTS WITH TYPE 2 DIABETES MELLITUS AT TERTIARY CARE CENTRE

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ABSTRACT

Background: The aim of the present study was to find the prevalence of thyroid dysfunction in patients with type 2 diabetes mellitus (type 2 DM) attending an outpatients department and medical wards in Dr D Y Patil Medical College and Hospital.

Materials and Methods: Data of 50 diabetic and 50 non diabetic patients who attended OPD and admitted in medical wards of Dr D Y Patil Medical College and Hospital, pimpri, pune from September 2012 to September 2013. These subjects were investigated for total triidothyronine (T_3), total thyroxin (T_4), thyroid stimulating hormone (TSH), Fasting Blood Sugar(FBS), glycosylated hemoglobin (HbA1c), serum cholesterol, serum triglycerides, high density lipoprotein(HDL), low densit lipoprotein(LDL), very low density lipoprotein(VLDL), blood urea, serum creatinine.

Results: The level of T3and T4were significantly lower while the level of TSH was significantly higher in type 2 diabetics as compared to non-diabetics. From the 50diabetic subjects studied, 30% showed abnormal thyroid hormone levels (22 % had hypothyroidism and 8 % had hyperthyroidism). Significantly higher levels of FBS, HbA1c, serum cholesterol, serum triglyceride, LDL, VLDL, blood urea, creatinine, and significantly lower level of HDL was observed in diabetics as compared to non-diabetics subjects.

Conclusion: The prevalence of thyroid dysfunction among type 2 DM patients is very high (30 %) with subclinical hypothyroidism is being most common. All patients with type 2 DM should be screened for thyroid dysfunction to reduce the mortality rate.

Key words: Diabetes, Hypothyroidism, Hyperthyroidism, TSH, LDL, HDL, VLDL

INTRODUCTION

The association between diabetes and thyroid dysfunction were first published in 1979.[1] Thyroid dysfunction is a disorders of the thyroid gland which manifests either as hyper - or hypothyroidism and is reflected in the levels of thyroid stimulating hormone (TSH).[2]Diabetes Mellitus is the commonest endocrine disorder, leading cause of death worldwide.[3]

The WHO estimated diabetes prevalence was 2.8% in 2000 and 4.4% in 2030. The total no. of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030.[4] Thyroid also most common endocrine disorder in the general population after diabetes.[5] After ,1979 a number of studies estimated prevalence of thyroid dysfunction among diabetes patients ranging from 2.2-17 %.[6,7,8]however, fewer studies have estimated higher prevalence of thyrodiabetics i.e. 31% and 46.5% respectively.[9,10]

Defective insulin secretion leads to various metabolic aberrations in T2DM, spanning from hyperglycemia due to defective insulin-stimulated glucose uptake and up regulated hepatic glucose production, along with dyslipidaemia, which includes impaired homeostasis of fatty acids, triglycerides, and lipoproteins.[11]

DM appears to influence thyroid function in two sites; 1stly at the level of hypothalamic control of TSH release and 2ndly at peripheral tissue by converting T_4 to T_3. Hyperglycemia causes reduction in hepatic concentration of $T_{4\text{-}5}$ deiodinase, low serum concentration of T_3,raised levels of reverse T_3 and low, normal, or high level of T_4. Thyroid hormone regulate metabolism and diabetes can alter metabolism. [12]

The aim of this study was to evaluate the prevalence of thyroid dysfunction in T2DM and also effect of the T2DM on other biochemical markers.

MATERIALS AND METHODS

Diabetic patients attending diabetic clinic OPD and admitted in medical wards in Dr. D. Y. Patil Hospital, Pune (50 diabetic patients (type II) and 50 non diabetic) were included in study group. All patients with diseases

(DKA and CRF) and drugs (Lithium and Amiodarone) that can affect thyroid disease were excluded.

Sample taking and Biochemical markers:

Criteria used in the study for diagnosis of type 2 DM (According to American Diabetic Association) are 1) FBS (Fasting Blood Sugar) - ≥ 110 mg/dl and 2) RBS (Random Blood Sugar) - ≥ 200 mg/dl or taking hypoglycemic drugs and/or using insulin and did not have any ketosis in the past.

Venous Blood sample were taken and assessed for thyroid function tests such T_3, T_4 and TSH and other biochemical markers such as FBS, HbA1c, lipid profile, blood urea, creatinine. Normal range of the serum[13] levels were 70-210 ng/dl for T_3; 5.5-11.8 μg/dl for T_4 and 0.3-5.5 μIU/ml for TSH.

Method: T_3 and T_4 estimated by using Chemi Lumination Immuno Assay (CLIA) and TSH was estimated using Ultra Sensitive CLIA method.

Normal ranges for FBS is 70-110 mg/dl; for HbA1c is 4.0-6.0%; for Total cholesterol is 150-200 mg/dl; for Serum triglycerides is 40-160 mg/dl; for Serum HDL is 35-60 mg/dl; for Serum LDL is <130 mg/dl; for Serum VLDL is 5-35 mg/dl; for Blood Urea is 15-45 mg/dl; and for Serum Creatinine is 0.5-1.5 mg/dl.

FBS was measured by GOD POD method; HbA1c by Hyper performance Lipid Chromatography (HPLC); TG by Enzymatic Colonometry method; HDL ,LDL and VLDL by Homogenous Enzymatic Colonometry Assay method; Urea by Ultra Violet Kinetic method and Creatinine by Picrate method.

Guidelines for detection of thyroid dysfunction:

- Normal – when T_3, T_4 and TSH were in normal range
- Primary Hypothyroidism – when TSH more than 5.5mIU/ml and T_3, T_4 less than normal.
- Primary Hyperthyroidism – when TSH is less than 0.3mIU/ml and T_3, T_4 more than normal.
- Subclinical Hypothyroidism – when TSH is more than 5.5 mIU/ml and T_3, T_4 is within normal range.
- Subclinical Hyperthyroidism – when TSH is less than 0.3 mIU/ml and T_3, T_4 is within normal range.

Statistical analysis: The results obtained and expressed in mean ± SD. The comparison was done by student t test and each parameter was done by SPSS statistical package version 15.0 (Chicago, USA).

RESULTS

The sex and age distribution of diabetic and non diabetic patients is shown in table 1. Type 2 DM patients include 18 males and 32 females whereas non diabetic patients include 22 males and 28 females with mean age of 43.16 ± 5.06 and 45.37 ± 6.19 respectively.

Table 2 shows the levels of various biochemical parameters in diabetic and non diabetic patients. Serum cholesterol, serum TG, LDL, VLDL, Blood urea, serum creatinine, fasting blood sugar and HbA1c were significantly higher in diabetic patients as compared to non diabetic patients.

Table 1: Sex and age wise distribution of diabetic and non diabetic patients.

Group	Male	Female	Mean Age (In Years)
Type 2 Diabetic patients	18	32	43.16 ± 5.06
Non Diabetic patients	22	28	45.37 ± 6.19

Table 2: Comparison of various Biochemical Parameters in Type 2 DM and Non Diabetic subjects

Investigations	Type 2 Diabetic Subjects (N = 50) (Mean ± SD)	Non Diabetic subjects (N =50) (Mean ± SD)	P Value
Serum Cholesterol(mg/dl)	204.96 ± 28.76	173.89 ± 8.34	<0.0001
Serum Triglycerides(mg/dl)	166.17 ± 31.92	131.06 ± 14.19	<0.0001
Serum HDL(mg/dl)	42.6 ± 5.12	43.4 ± 4.84	0.0184
Serum LDL(mg/dl)	118.14 ± 24.11	99.78 ± 8.52	<0.0001
Serum VLDL(mg/dl)	35.68 ± 7.09	27.26 ± 3.15	<0.0001
Blood Urea(mg/dl)	33.15 ± 7.32	31.11 ± 3.07	<0.0001
Serum Creatinine(mg/dl)	1.3 ± 0.3	1.00 ± 0.09	<0.0001
F-BSL(mg/dl)	164.0 ± 15.18	86.92 ± 6.74	<0.0001
HbA1c(% age)	7.38 ± 0.72	5.12 ± 0.21	<0.0001

Table 3 shows the level of serum thyroid hormones in diabetic and non diabetic patients. The serum levels of $T_3$and T_4 were significantly lower in diabetic compared to non diabetic patients whereas level of serum TSH was significantly higher in diabetic patients as compare to non diabetic patients. Similar results were observed in Punjabi population of North India.[25]

Table 4 shows thyroid disorder according to the gender in type 2 DM and non diabetic control subjects. Out of 50 type2 DM subjects, 30 % shows abnormal thyroid functions (22% had hypothyroidism and 8 % had hyperthyroidism) and 70 % shows normal thyroid functions. The incidence of thyroid disorder is more in females as compare to males in type 2 DM.

Table 3: Comparison of Thyroid Function Test in Type 2 Diabetic and Non Diabetic Subjects

Investigations	Type 2 Diabetic Subjects (N = 50) (Mean ± SD)	Non Diabetic subjects (N =50) (Mean ± SD)	p Value
Serum T_3(ng/dl)	124.8 ± 44.13	151.4 ± 12.97	<0.0001
Serum T_4(ug/dl)	7.17 ± 3.11	8.12 ± 0.78	0.0009
Serum TSH(uIU/ml)	7.61 ± 7.38	2.59 ± 1.11	<0.0001

Table 4: Type of Thyroid disorders according to gender in type 2 DM and non diabetic group

Group	Gender	Subclinical Hypothyroidism	Primary Hypothyroidism	Subclinical Hyperthyroidism	Primary Hyperthyroidism
Type 2 DM (N = 50)	Male	3	2	0	2
	Female	4	2	0	1
Non Diabetic (N = 50)	Male	1	0	0	0
	Female	2	0	0	1

DISCUSSION

In our study diabetic patients shows significant higher serum levels of cholesterol, triglycerides, LDL, VLDL and lower level of HDL as compared to non diabetic patients. Similar study among young adult population was done by Sawant et al [14] showed similar results.

While dyslipidemia is a reported complication of overt hypothyroidism in nondiabetic[15-17] and diabetic[18] subjects. A study by Chubb et al.[19] did not find any significant relationship between subclinical hypothyroidism and the presence of dyslipidemia. Other studies reported that thyroid hormones are necessary for the mobilization of the tissue lipids especially brown adipose tissues (BATs) which are the fuel for the production of heat.[20] those patients were under thyroid hormone replacement therapy, showed to improve serum lipids, in particular LDL-c levels.[21,22]

There was significant increase in blood urea and serum creatinine in diabetic control subjects. Similar results were observed in Diabetic Nepalese.[23]

Due to high blood sugar there is damage to the nephrons. As a result, kidneys unable to maintain the fluid and electrolytes homeostasis. There is rise in plasma concentration of serum creatinine and urea. In severe hyperglycemia, there is formation of advanced glycation end-products (AGEs) has long been recognized to cause cellular injury. AGEs accelerates increased vascular permeability, basement membrane thickening and mesangial fibrosis. This process leads to renal failure.[24]

Significantly lower level of $T_3$and T_4 and higher level of TSH in diabetic group is similar to the result observed in Punjabi population of North India.[25]

In the present study high prevalence of thyroid disorder is reported in type 2 DM. Our observations are consistence with previous similar studies performed by Ghazali S M et al[26], Gurjeet singh et al[25], Radaideh AR et al[8], Laloo Demitrost et al[27], Diaz et al[28], Perros et al[6] and Athanasia Papazafiropoulou et al[29] reported 29.7 %, 30 %, 12.5 %, 31.2 %, 32.4 %, 13.4 % and 12.3 % respectively.

Hypothyroidism is present 22 % (14% subclinical hypothyroidism and 8 % primary hypothyroidism) and hyperthyroidism is present in 8 % (all Primary hyperthyroid subjects) of diabetic subjects. Similar study was conducted by Laloo Demitrost et al[27]observed (68.8%) were euthyroid, 33 (16.3%) had subclinical hypothyroidism (10 males and 23 females), 23 (11.4%) had hypothyroidism (6 males and 17 females), 4 (2%) had subclinical hyperthyroidism and 3 (1.5%) were hyperthyroidism cases).

CONCLUSION

This study show high prevalence (30 %) of thyroid dysfunction in type 2 DM. Subclinical hypothyroidism being the most common in type 2 DM. So, routine assay of thyroid hormones in type 2 DM is needed in those patients whose conditions are difficult to manage.

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