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Original Article

Prevalence of thyroid disorders in North Indian Type 2 diabetic subjects: A cross sectional study

Maaz Ozair[a], Saba Noor[a], Alok Raghav[a], Sheelu Shafiq Siddiqi[a], Anjum Mirza Chugtai[b], Jamal Ahmad[a,*]

[a] Rajiv Gandhi Centre for Diabetes and Endocrinology, Faculty of Medicine, J.N. Medical College, Aligarh Muslim University, Aligarh, India
[b] Department of Medicine, Faculty of Medicine, Aligarh Muslim University, Aligarh, India

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ABSTRACT

Background: Type 2 diabetes mellitus (T2DM) is a major health burden worldwide with many patients encountering thyroid dysfunction later in their life. Various studies have found that diabetes and thyroid disorders mutually influence each other and both disorders tend to coexists. However, the prevalence of thyroid dysfunction and associated clinical variables in these patients has not been investigated.
Objectives: The study aimed at determining the incidence and prevalence of thyroid dysfunction in patients with T2DM in relation to age, sex, metabolic syndrome and other co-morbid conditions.
Research designs & methods: In this cross-sectional study, 250 Type 2 DM patients were enrolled aged between 40 and 75 years. All the patients were evaluated for thyroid dysfunction by testing thyroid profile (T3, T4 and TSH. These subjects were also investigated for fasting blood sugar (FBS), post prandial glucose (PPG) glycosylated hemoglobin (HbA1c), serum cholesterol, serum triglycerides, high density lipoprotein (HDL), low density lipoprotein(LDL), very low density lipoprotein(VLDL), blood urea, serum creatinine and presence of other co-morbid conditions. The observations and interpretations were recorded and results obtained were statistically analyzed.
Results: A high prevalence of thyroid dysfunction (28%) was observed in type 2 diabetic patients with subclinical hypothyroidism (18.8%) as the commonest thyroid disorder. Thyroid dysfunction was more prevalent in females, with presence of dyslipidemia, retinopathy, poor glycemic state (HbA1c $\geq$7) and longer duration of diabetes as significant contributing factors associated.
Conclusions: In addition to glycemic status, screening of thyroid disorder should be routinely done in type 2 diabetic subjects along with other comorbid conditions.

1. Introduction

Thyroid disorders and diabetes mellitus (DM) are two most common endocrinological disorders encountered in clinical practice [1,2]. Diabetes and thyroid disorders have been found to reciprocally influence each other and association between both these conditions has long been reported. The prevalence of thyroid dysfunction is elevated in diabetics as compared to the general population. In contrast, diabetes mellitus shows a higher prevalence – 10.8% in the community and up to 13.4% in a hospital diabetic clinic. Thyroid disorders are more common in patients with type 1 DM due to common autoimmune origin but now there have been studies showing increased prevalence of thyroid disorders in type 2 DM as well [3]. In addition to autoimmune link between type 1 DM and thyroid disorders, both diabetes and thyroid disease are commonly found in elderly, further contributing to the higher association [4]. The most common thyroid dysfunction in diabetics reported in most of the studies is subclinical hypothyroidism (4.8%) [5]. There is a deep unexplored relation between thyroid dysfunction and diabetes mellitus. Thyroid hormones influence the regulation of carbohydrate metabolism and pancreatic function, whereas diabetes also affects thyroid function tests to a variable level. A number of studies have stated an array of complex intertwining biochemical, genetic, and hormonal abnormalities mirroring this patho-physiological association [6]. However, underlying thyroid disorders may go undiagnosed because the common signs and symptoms of thyroid disorders are similar to those for diabetes and can be overlooked or attributed to other medical disorders.

The association between type 2 DM and thyroid dysfunction has not been deeply explored which may behold answers to various

* Corresponding author.
E-mail address: jamalahmad11@rediffmail.com (J. Ahmad).

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facts of metabolic syndrome including atherosclerosis, hypertension, and related cardiovascular disorders. Only few studies have been carried out on Indian population for finding out the prevalence of thyroid disorders in Type 2 DM [7,8]. The recognition of this interdependent relationship between thyroid dysfunction and T2DM is vital in guiding the optimal management of both these pathologies. The present study was carried out to determine the incidence and prevalence of thyroid dysfunction in patients of type 2 DM coming to our institution, especially in relation to complications of diabetes.

2. Material & methods

2.1. Study designs

A cross-sectional hospital-based study was conducted in Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh, India during the period from July 2014 to March 2016. Two hundred and fifty 2 diabetic patients were enrolled in this study. Subjects on drugs affecting thyroid function, pregnant females, type 1 DM and those with immunological or rheumatological disorders were excluded from the study. All the subjects gave informed consent, and clearance was obtained from the Bio-Ethical Committee (BEC), Faculty of Medicine, J.N. Medical College, Aligarh Muslim University, Aligarh.

2.2. Clinical examination

A well-structured questionnaire was developed for a detailed history and physical examination. Subjects were clinically assessed for age, sex, body mass index (BMI), lipid profile, duration of diabetes, glycemic status, liver, and renal functionality. Patients were also clinically evaluated for presence of other comorbidities such as retinopathy (fundoscopy), neuropathy (absence of perception of the Semmes–Weinstein monofilament at 2 of 10 standard planter sites on either foot), nephropathy (creatinine $>$ 1.5 mg% or presence of micro- or macroalbuminuria), hypertension (previous medication of anti1 hypertensive drug or a BP $\geq$ 140/90 mmHg), peripheral vascular disease (ischemic symptoms and intermittent claudication of rest pain, with or without absence of pedal pulses or posterior tibial pulses) and dyslipidemia.

2.3. Specimen collection, evaluation and diagnosis

Blood samples were taken after no caloric intake of 8 h for estimation of fasting plasma glucose, HbA1c, thyroid and lipid profiles. All evaluations were done in the laboratory of the

Plasma/serum obtained at the day of admission were processed for estimation of HbA1c by ion-exchange high-performance liquid chromatography (Bio-Rad D-10, India) and glucose estimation by colorimetric assays. Serum lipid analysis (triglycerides, total cholesterol, LDL-cholesterol, HDL-cholesterol, VLDL-cholesterol, and phospholipids) was done using commercially available kits (Avantor, U.S.A) according to manufacturer guidelines Allain et al. [9]. The Criteria used for diagnosing diabetes was that adapted by American Diabetic Association, 2014 [10] (FPG $\geq$ .7.0 mmol/L, or two-hour plasma glucose $\geq$ 11.1 mmol/L, or random blood glucose concentration $\geq$ 11.1 mmol/L along with symptoms of diabetes, or HbA1c $\geq$ 6.5%). The diagnosis of thyroid dysfunction was made according to the American Thyroid Association/American Association of Clinical Endocrinologist Guidelines:

2.3.1. Subclinical hypothyroidism

A serum TSH of more than 4.5 mIU/ml, in combination with a normal free T4 [11].

2.3.2. Overt hypothyroidism

An elevated TSH, usually above 10 mIU/L, in combination with a subnormal free T4 [11]

2.3.3. Overt hyperthyroidism

A TSH of less than 0.01 mIU/L with raised free T4 [11]

2.3.4. Subclinical hyperthyroidism

A TSH of less than 0.01 mIU/L with normal free T4 [11].

2.4. Statistical analysis

Quantitative variables were represented as means $\pm$ standard deviation and categorical data as a percentage (%). Student's *t*-test or chi- square test was used to compare the differences between the groups. A two-tailed p-value < 0.05 was considered as statistically significant. All statistical analysis was performed using SPSS software.

3. Results

In this prospective study, 250 type 2 diabetic subjects were screened for thyroid dysfunction. Thyroid disorder was found in 28% of the subjects enrolled. The clinical and demographical characteristics of diabetic patients in euthyroid group and thyroid dysfunction are given in Table 1. The mean age of patients in the euthyroid group was 51.13 ± 10.45 years while it was 52.04 ± 9.85 years in patients with thyroid dysfunction. Increased body mass index (BMI), raised diastolic blood pressure, decreased serum total cholesterol and increased high density lipoprotein were found in diabetic subjects with thyroid disorder then subjects in euthyroid group. The difference in the above mentioned variables were statistically significant ($p < 0.05$). Among the categories of thyroid disorders, subclinical hypothyroidism (18.8%) was the most common form of thyroid dysfunction seen followed by overt hypothyroidism (8%) and overt hyperthyroidism (1.2%). There was no subject suffering from subclinical hyperthyroidism.

Table 1
Clinical and demographical variables of subjects enrolled.

Variables	Euthyroid	Thyroid disorder	*p value*
N	180	70	
M/F	40/140	30/40	NS
Age (years)	51.1 ± 10.4	52.0 ± 9.8	NS
BMI (kg/m2)	22.7 ± 4.5	25.2 ± 4.9	S
FBS (mg/dL)	169.2 ± 69.6	172.0 +76.4	NS
PPG (mg/dL)	237.9 ± 87.0	242.3 ± 100.1	NS
HbA1c (%)	7.8 ± 1.8	8.14 ± 1.8	NS
Diabetes duration (yrs)	4.7 ± 3.9	5.3 ± 4.1	NS
BMI (kg/m^2)	24.07 ± 4.93	25.26 ± 5.51	NS
Sys BP (mm Hg)	133.3 ± 37.1	129.2 ± 10.8	NS
Dia BP (mm Hg)	83 ± 12.6	85.7 ± 6.1	S
Lipid Profile			
TAGs (mg/dL)	162.1 ± 21.2	144.1 ± 27.4	NS
TC(mg/dL)	183.1 ± 54.8	148.3 ± 38.9	S
HDL(mg/dL)	41.4 ± 6.6	35.6 ± 9.2	S
LDL(mg/dL)	77.6 ± 7.1	69.2 ± 11.9	NS
Complications			
Retinopathy (%)	27(15.0)	18 (25.7)	NS
Nephropathy (%)	26 (14.4)	12 (17.1)	S
Dyslipidemia (%)	48 (26.6)	29 (41.4)	S
Hypertension (%)	101 (56.6)	38 (54.2)	NS

Data are means $\pm$ SD, or n (%).
HbA1c, glycated hemoglobin; **FPG**, fasting plasma glucose; **PPG**, postprandial glucose; Sys **BP**, systolic blood pressure; **Dia BP**, diastolic blood pressure; **TC**, total cholesterol; **TAG**, triglycerides; **HDL**, high density lipoprotein; **LDL**, low density lipoprotein; **NS,** not significant; S, significant.

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