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Original Research Article

Determining the Level of Thyroid Dysfunction in Patients with Type 2 Diabetes Mellitus and Its Association with Diabetic Complications

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Abstract

Aim: The aim of this study was to assess the level of thyroid dysfunction in patients with type 2 diabetes mellitus and to identify the association of thyroid dysfunction with diabetic complications.

Methods: This retrospective study was conducted in the Department of Medicine, Mata Gujari Memorial Medical College, Kishanganj, Bihar, India from October 2018 to September 2019. A total of 200 participants were included in this study.

Results: The mean duration of diabetes was 6.34 ± 2.42 years and the mean glycosylated hemoglobin was 9.3 ± 2.66% among the study population. There were male predominance and the maximum number of diabetic patients included in this study was in the age group of 41-70 years. A majority of study subjects (>80%) had normal TSH, free T3 and free T4 values. Both types of thyroid dysfunction (hypothyroidism & hyperthyroidism) were more common in females as compared to males and mostly involved 41-50 years of age.

Conclusion: The prevalence of thyroid dysfunction was 18% among patients with type 2 diabetes mellitus in this study. Hypothyroidism was more common among the study subjects than hyperthyroidism. There was no correlation of thyroid dysfunction with diabetic complications.

Keywords: Diabetic complications, thyroid dysfunction, type 2 diabetes mellitus.

Introduction

Diabetes mellitus (DM) and thyroid dysfunction (TD) are endocrinopathies that are commonly seen in routine practice, and they frequently coexist. A high prevalence of TD is seen among both type 1 (T1DM) and type 2 (T2DM) diabetes mellitus patients. [1,2]

Both T2DM and TD are chronic diseases that require lifelong treatment and have a long-lasting effect on cardiovascular health. According to the International Diabetes Federation (IDF), in the year 2017, approximately 425 million adults worldwide were living with diabetes. [3] The total prevalence of diabetes is increasing and is expected to be 629 million by 2045. [3]

As per a large European meta-analysis, TD is present in 3.82% of the general population. [4] Its prevalence among those with T2DM is significantly higher, ranging from 9.9 to 48%. [5,6] This wide range of prevalence can be explained by the use of different definitions for TD diagnosis, depending on the presence of anti-thyroid peroxidase (anti-TPO), antithyroglobulin antibody (anti-TG), or both. In many studies, most T2DM patients with TD had subclinical hypothyroidism (SCH), and several new cases of TD were diagnosed during clinical evaluations, highlighting the need for enhanced screening for TD in T2DM patients. [5,7,8] Just as in the nondiabetic population, TD was found to be more common in females than in males with diabetes. [8-10] TD is more common in T1DM than in T2DM patients, but the pathophysiology is more complex in T2DM patients and has greater clinical implications.

The aim of this study was to assess the level of thyroid dysfunction in patients with type 2 diabetes mellitus and to identify the association of thyroid dysfunction with diabetic complications.

Materials and Methods

This retrospective study was conducted in the Department of Medicine, Mata Gujari Memorial

Medical College, Kishanganj, Bihar, India from October 2018 to September 2019. A total of 200 participants were included in this study.

Patients with known thyroid disease, acute illness and chronic liver disease were excluded from the study.

Data regarding age and duration of diabetes were noted in the proforma of the study subjects. Assessment of body mass index (BMI) was done in all the subjects. Body weight was measured using an electronic scale to the nearest 0.1 kg. Subjects were asked to stand straight and relaxed with minimum clothing. Height was measured to the nearest 0.1 cm by using the wall-mounted stadiometer. The height of the subjects was taken in the standing position, without footwear keeping head in the Frankfurt plane. BMI was subsequently calculated dividing the body weight in kilograms by the square of height in meters. BMI between 25 and 29.9 kg/m2 was taken as overweight while BMI above 30 kg/m2 was taken as obesity for the purpose of this study. Blood pressure was measured in the study subjects with the help of a digital BP instrument. Subjects with BP above 140/90 mm Hg were considered to be hypertensive for the purpose of this study.

The laboratory investigations that were performed were glycosylated hemoglobin, fasting lipid profile and urine albumin. Screening for diabetic retinopathy was done by dilated fundus examination. Diabetic retinopathy was classified as non-proliferative (NPDR) or proliferative (PDR) in the study subjects. NPDR was further sub-divided into mild, moderate and severe categories. Twelve lead electrocardiogram (ECG) was taken for evaluation of cardiovascular disease. Study subjects with changes suggestive of ischemia on ECG were considered to have ischemic heart disease. Vibration perception threshold (VPT) was performed in subjects clinically suspected to have diabetic neuropathy. Based on VPT findings, the study subjects were defined as not having neuropathy, mild or severe neuropathy. Diabetic nephropathy was considered to be present if there was albuminuria. Microalbuminuria was defined as urinary albumin excretion of 30-300 mg/day while macroalbuminuria was defined as presence of urinary albumin of more than 300 mg/day. Microalbuminuria was estimated with the help of nephelometry technique in the biochemistry laboratory.

Biochemical Analysis

Serum TSH (Thyroid Stimulating Hormone), free T3 (Triiodothyronine) and free T4 (Thyroxine) were assessed in the fasting serum samples of the study subjects using chemiluminescent immunoassay method technology (ADVIA Centaur XP, Siemens Healthcare Global, USA). The normal range of TSH was 0.35-5.5 mU/L, 2.3-4.2 pg/ml for free T3 and 0.89-1.76 ng/dL for free T4. Sub-clinical hypothyroidism was defined as subjects with TSH value between 5-10 mU/L and normal free T3& T4 levels. Overt hypothyroidism was present in subjects with TSH value above 10 mU/L and low free T3 & T4 levels. Sub-clinical hyperthyroidism was defined as low TSH with normal free T3& T4 levels. Overt hyperthyroidism was defined as low TSH with high free T4 levels. Serum creatinine was estimated by using enzymatic Jaffe's method. Lipid profile was also done for all the study subjects. Dyslipidemia was considered to be present if total serum cholesterol was above 200 mg/dL. Glycosylated hemoglobin was done in all study subjects by high performance liquid chromatography (HPLC) technique in the laboratory.

Statistical Analysis

All statistical analysis was carried out at 5% level of significance and P value below 0.05 was considered as significant using SPSS version 21.

Results

Table 1: Baseline characteristics of study participants

Parameter	Mean	Standard deviation
BMI (kg/m^2)	26.04	5.75
Duration of diabetes (years)	6.34	2.42
HbA1c (%)	9.3	2.66

The mean duration of diabetes was 6.34 ± 2.42 years and the mean glycosylated hemoglobin was 9.3 ± 2.66% among the study population.

Table 2: Demographic data

Gender	N	%
Male	120	60
Female	80	40
Age groups in years		
21-30	4	2
31-40	26	13

41-50	40	20
51-60	74	37
61-70	40	20
71-80	15	7.5
>80	1	0.5

There were male predominance and the maximum number of diabetic patients included in this study was in the age group of 41-70 years.

Table 3: Thyroid function test results of study participants

Parameter	Normal range	Increased value	Decreased value
Serum TSH	164	26	10
Free T3	170	4	26
Free T4	180	10	10

A majority of study subjects (>80%) had normal TSH, free T3 and free T4 values.

Table 4: Thyroid dysfunction in study subjects according to gender and age

Gender	Hypothyroidism	Hyperthyroidism
Male	14	4
Female	12	6
Total	26	10
Age groups		
21-30	0	1
31-40	2	1
41-50	6	4
51-60	7	1
61-70	6	1
71-80	4	1
>80	1	1
Total	26	10

Both types of thyroid dysfunction (hypothyroidism & hyperthyroidism) were more common in females as compared to males and mostly involved 41-50 years of age.

Discussion

Patients with type 2 diabetes mellitus are more prone to develop thyroid disorders. Many diabetic patients show features of thyroid dysfunction over a period of time. [11] Insulin resistance plays an important role in the development of hypothyroidism in patients with type 2 diabetes mellitus. Hypothyroidism in diabetic patients leads to an aggravation of dyslipidemia, hypertension and cardiovascular disease. [12] Thus, it is necessary to recognize and treat hypothyroidism in diabetic patients to prevent worsening of diabetic complications. [13] Hypothyroidism can be diagnosed with the help of a simple blood test which is readily and easily available. This can be performed by the primary care physician involved in treating diabetic patients. Early treatment of thyroid dysfunction in diabetic patients will help in normalizing their glycemic status and lipid profile.

The prevalence of thyroid dysfunction among diabetic patients in our study was found to be 18%. Hypothyroidism was more common among the study subjects. This is similar to a study done in south India by Jali MV et al [14] that showed the prevalence of thyroid dysfunction among diabetic patients to be 16.2%. Another study done in north India showed that prevalence of sub-clinical hypothyroidism in diabetic patients was 18.8%. This study also found that prevalence of thyroid dysfunction was more among females, patients with dyslipidemia and retinopathy and patients with poor glycemic control & long duration of diabetes. [8] The mean duration of diabetes was 6.34 ± 2.42 years and the mean glycosylated hemoglobin was 9.3 ± 2.66% among the study population. There were male predominance and the maximum number of diabetic patients included in this study was in the age group of 41-70 years. A majority of study subjects (>80%) had normal TSH, free T3 and free T4 values. Both types of thyroid dysfunction (hypothyroidism & hyperthyroidism) were more common in females as compared to males and mostly involved 41-50 years of age.

The study also showed that thyroid dysfunction was not linked to the duration of diabetes, glycosylated hemoglobin and the presence of diabetic complications. [15] The study findings are in line with the present study which did not show a correlation between thyroid dysfunction and diabetic complications in the study subjects. However, another study done in Egypt showed that prevalence of thyroid dysfunction increased with an increase in glycosylated hemoglobin which suggests that poor glycemic control could play a role in the occurrence of thyroid dysfunction in diabetic patients. [16]

Conclusion

The prevalence of thyroid dysfunction was 18% among patients with type 2 diabetes mellitus in this study. Hypothyroidism was more common among the study subjects than hyperthyroidism. There was no correlation of thyroid dysfunction with diabetic complications.

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