e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2023; 15(10); 831-836

Original Research Article

To Investigate the Importance of Thyroid Dysfunction in Patients with Type II Diabetes Mellitus: A Retrospective Study

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Received: 15-08-2023 / Revised: 20-09-2023 / Accepted: 26-10-2023
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Conflict of interest: Nil

Abstract

Aim: To investigate the importance of thyroid dysfunction in patients with type II diabetes mellitus in the Bihar area, specifically in relation to age and duration of diabetes.

Material and Methods: This retrospective study was conducted in the Department of Community medicine, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India from January 2018 to December 2018. 331 participants were included in this study. Convenient sampling technique was used to include diabetic patients attending the Medicine and Endocrinology OPDs of the hospital. s with known thyroid disease, acute illness and chronic liver disease were excluded from the study. The laboratory investigations that were performed were glycosylated haemoglobin, 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.

Results: The mean duration of diabetes was 6.37 ± 2.41 years and the mean glycosylated haemoglobin was 9.3 ± 2.66% among the study population. The maximum number of diabetic patients included in this study were in the age group of 41-70 years. A majority of study subjects (> 80%) had normal TSH, free T_3 and free T_4 values. Hypothyroidism was seen in 13.9% while hyperthyroidism was seen in only 3.6% of subjects. The study population according to age, gender, duration of diabetes and glycaemic status. Both types of thyroid dysfunction (hypothyroidism & hyperthyroidism) were more common in females as compared to males. There was no correlation of thyroid dysfunction with diabetic nephropathy in the study subjects. Similarly, there was no correlation of thyroid dysfunction in diabetic patients with cardiovascular disease, neuropathy and retinopathy.

Conclusion: The prevalence of thyroid dysfunction was 17.5% 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: thyroid dysfunction, type II diabetes mellitus, age, duration of diabetes.

Introduction

Diabetes mellitus (DM) is the most common endocrine disorder caused by the dysfunction of pancreatic b cells. [1] In 2019, it was reported that globally 463 million adults (age 20–79 years) were living with diabetes, 79% of whom were living in low- and middle-income countries. [1] According to the American Diabetes Association (ADA), additional 374 million people are at risk for developing type 2 diabetes mellitus (T2DM). [2] Thyroid dysfunction is ranked as the second most common endocrine disorder. [3] In the USA, 4.6% of the population were diagnosed with hypothyroidism, and 1.3% had hyperthyroidism, whereas these figures were 3.05% and 0.75% in Europe, respectively. [4] It has been documented that diabetic patients are more susceptible to developing thyroid dysfunction, and many clinical trials have been conducted across the globe to understand the link between them. [5] Several studies have reported the prevalence of thyroid dysfunction among patients with DM to be varying from 4% to 35%. [6,7,8] Recent studies have

reported insulin resistance as a major factor in disrupting thyroid hormone functions and causing hypothyroidism in T2DM patients. [5] It does this by modifying thyroid-stimulating hormone (TSH) released from the hypothalamus or affecting peripheral tissue conversion of tetraiodothyronine (T4) to triiodothyronine (T3). [5,9] In subclinical hypothyroidism, the declining rate of insulin-induced glucose transport is thought to be due to the disrupted gene translocation of glucose type 2 receptor (GLUT-2), leading to insulin resistance. [10]

Material and Methods

This retrospective study was conducted in the Department of Community Medicine, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India, from January 2018 to December 2018. 331 participants were included in this study. Convenient sampling technique was used to include diabetic patients attending the Medicine and Endocrinology OPDs of the hospital. 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/m^2 was taken as overweight while BMI above 30 kg/m^2 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 haemoglobin, 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 T_3 (Triiodothyronine) and free T_4 (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 T_3 and 0.89-1.76 ng/dL for free T_4. Sub-clinical hypothyroidism was defined as subjects with TSH value between 5-10 mU/L and normal free T_3& T_4 levels. Overt hypothyroidism was present in subjects with TSH value above 10 mU/L and low free T_3 & T_4 levels. Sub-clinical hyperthyroidism was defined as low TSH with normal free T_3& T_4 levels. Overt hyperthyroidism was defined as low TSH with high free T_4 levels. Serum creatinine was estimated by using enzymatic Jaffe's method. Lipid profile was also done for all the study subjects. Dyslipidaemia was considered to be present if total serum cholesterol was above 200 mg/dL. Glycosylated haemoglobin was done in all study subjects by high performance liquid chromatography (HPLC) technique in the laboratory.

Statistical Analysis

Data on continuous variables like age, duration of diabetes, BMI, HbA1c and lipid profile were expressed as mean with standard deviation (SD). Independent student's t test was done to compare continuous variables between two independent groups. Categorical variables like proportion of subjects having thyroid dysfunction, hypertension, dyslipidaemia, obesity and diabetic complications were expressed as a percentage and were analysed by Chi-square test (χ^2). All statistical analysis was carried out at 5% level of significance and *P* value below 0.05 was considered as significant.

Results

A total of 331 participants were included in this study. The baseline characteristics of the study subjects are given in Table 1. The mean duration of diabetes was 6.37 ± 2.41 years and the mean glycosylated haemoglobin was 9.3 ± 2.66% among the study population.

Table 1: Baseline characteristics of study participants

Parameter	Mean	Standard deviation
BMI (kg/m^2)	26.07	5.82
Duration of diabetes (years)	6.37	2.41
HbA1c (%)	9.3	2.66

The age and gender of the study subjects are given in Table 2. The maximum number of diabetic patients included in this study were in the age group of 41-70 years.

Table 2: Age and gender distribution of study participants

Male	Female
174	157
Age (years)	*n*=331
21-30	8
31-40	41
41-50	87
51-60	109
61-70	67
71-80	18
>80	1

Table 3 shows the result of thyroid function test in the study subjects. A majority of study subjects (> 80%) had normal TSH, free T_3 and free T_4 values. Hypothyroidism was seen in 13.9% while hyperthyroidism was seen in only 3.6% of subjects.

Table 3: Thyroid function test results of study participants

Parameter (*n*=331)	Normal range	Increased value	Decreased value
Serum TSH	273 (82.48%)	46 (13.89%)	12 (3.63%)
Free T3	287 (86.71%)	6 (1.82%)	38 (11.49%)
Free T4	301 (90.94%)	16 (4.84%)	14 (4.23%)

Diabetic nephropathy in study subjects was based on the presence of albuminuria. This was further classified into microalbuminuria (<300 mg albumin/gram of creatinine) and macroalbuminuria (>300 mg albumin/gram of creatinine). Tables 4-7 depict the presence of thyroid dysfunction in the study population according to age, gender, duration of diabetes and glycemic status. Both types of thyroid dysfunction (hypothyroidism & hyperthyroidism) were more common in females as compared to males.

Table 4: Thyroid dysfunction in study subjects according to gender

Gender	Hypothyroidism	Hyperthyroidism
Male	22 (47.83%)	5 (41.66%)
Female	24 (52.17%)	7 (58.33%)
Total	46	12

Table 5: Thyroid dysfunction in study subjects according to glycemic status

HbA1c (%)	Hypothyroidism	Hyperthyroidism
6.5-7	8	3
7.1-8	9	2
8.1-9	8	2
Above 9	21	5

Table 6: Thyroid dysfunction in study subjects according to age

Age group (years)	Hypothyroidism	Hyperthyroidism
21-30	-	1
31-40	5	3
41-50	10	5
51-60	12	1
61-70	14	2
Above 70	5	-

Table 7: Thyroid dysfunction in study subjects according to duration of diabetes

Duration of diabetes	Hypothyroidism	Hyperthyroidism
Below 1 year	6	5
1-5 years	16	6
5-10 years	12 (26.08%)	-
Above 10 years	12 (26.08%)	1

Table 8 shows that there was no correlation of thyroid dysfunction with diabetic nephropathy in the study subjects. Similarly, there was no correlation of thyroid dysfunction in diabetic patients with cardiovascular disease, neuropathy and retinopathy. [Tables 9-11].

Table 8: Correlation of thyroid dysfunction with diabetic nephropathy in study participants

Parameter	Hypothyroidism	Hyperthyroidism	p
Microalbuminuria	39	10	
Macroalbuminuria	7	2	0.99

Table 9: Correlation of thyroid dysfunction with cardiovascular disease in study participants

Parameter	Hypothyroidism	Hyperthyroidism	p
Normal ECG	37	10	0.32
Abnormal ECG	9	2	

Table 10: Correlation of thyroid dysfunction with diabetic retinopathy in study participants

Parameter	Hypothyroidism	Hyperthyroidism	p
Normal fundus	32	11	0.55
Mild NPDR	11	0	
Moderate NPDR	3	1	
Severe NPDR	0	0	

Table 11: Correlation of thyroid dysfunction with diabetic neuropathy in study participants

Parameter	Hypothyroidism	Hyperthyroidism	p
Normal VPT	32	9	0.56
Abnormal VPT			
1. Mild neuropathy	8	0	
2. Severe neuropathy	6	3	

Discussion

Insulin resistance that is typically seen in patients with type 2 diabetes mellitus plays a major role in the development of thyroid dysfunction in such patients. Thyroid dysfunction can occur in the form of hypothyroidism and hyperthyroidism. Sub-clinical hypothyroidism can also occur in diabetic patients and can contribute to diabetic complications like retinopathy, neuropathy and cardiovascular disease. [7]

The prevalence of thyroid dysfunction among diabetic patients in our study was found to be 17.5%. Hypothyroidism was more common among the study subjects. This is similar to a study done in south India by Jali MV *et al*. that showed the prevalence of thyroid dysfunction among diabetic patients to be 16.2%. [8] 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 dyslipidaemia and retinopathy and patients with

poor glycaemic control & long duration of diabetes. [9] A retrospective study done by Demitrost L *et al*. showed that hypothyroidism was seen in 11.4% of type 2 diabetic patients while hyperthyroidism was seen in only 1.5% of the cases. [1] A study to assess the prevalence of thyroid dysfunction in patients with type 2 diabetes mellitus was done by Diez JJ *et al*. and it was found that 15.1% of the patients had overt hypothyroidism while overt hyperthyroidism was seen in 3.5% of the patients. The study also showed that thyroid dysfunction was not linked to the duration of diabetes, glycosylated hemoglobin and the presence of diabetic complications. [10] 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 haemoglobin which suggests that poor glycaemic control could play a role in the occurrence of thyroid dysfunction in diabetic patients. [11]

Our study showed that duration of diabetes (more than 5 years) was an important factor in patients with hypothyroidism. However, this was not found in diabetic patients having hyperthyroidism. A study that was done by Metab Al-Geffari *et al*. showed that duration of diabetes (more than 10 years) was an important risk factor for the development of thyroid dysfunction among type 2 diabetic patients in their study population. [12]

Apart from insulin resistance, autoimmunity may also have a role in the development of thyroid dysfunction in patients with type 2 diabetes mellitus. A study done by Radaideh AR *et al*., showed that 12.5% of diabetic patients were found to have thyroid disease. Among the diabetic patients with thyroid dysfunction, thyroid peroxidase antibody was found to be positive in 8.3% of cases. This study showed that screening for asymptomatic thyroid dysfunction may be helpful in diagnosing thyroid disease among diabetic patients. [13]

Hypothyroidism can be associated with an increased risk of nephropathy and cardiovascular disease among diabetic patients. This was shown in a study done by Chen HS *et al*. that found sub-clinical hypothyroidism to be a risk factor for nephropathy and cardiovascular disease among type 2 diabetic patients. [4] However, our study showed that there was no correlation of thyroid dysfunction with nephropathy and cardiovascular disease in patients with type 2 diabetes mellitus.

Thyroid dysfunction is a common occurrence among patients with type 2 diabetes mellitus. It is more pronounced in patients with long-standing diabetes and female gender. Treatment of thyroid dysfunction in diabetic patients can improve their morbidity and prevent worsening of diabetic complications.

Conclusion

The prevalence of thyroid dysfunction was 17.5% 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.

References

1. Subekti I, Pramono LA, Dewiasty E, Harbuwono DS. Thyroid dysfunction in Type 2 diabetes mellitus patients. *Acta Med Indones* . 2017;49:314–23. [PubMed] [Google Scholar]
2. Jain G, Marwaha TS, Khurana A, Dhoat PS. Prevalence of thyroid disorders in patients of type 2 diabetes mellitus. *J Indian Acad Clin Med.* 2016;17:12–5. [Google Scholar]
3. Bhusal K, Pokhrel P, Simkhada R. Thyroid dysfunction among patients with diabetes mellitus in Kathmandu. *J CollMed SciNepal* . 2018;14:206–8. [Google Scholar]
4. Vikhe VB, Kanitkar SA, Tamakuwala KK, Gaikwad AN, Kalyan M, Agarwal RR. Thyroid dysfunction in patients with type 2 diabetes mellitus at tertiary care centre. *Natl JMed Res.* 2013;3:377–80. [Google Scholar]
5. Duntas L, Orgiazzi J, Brabant G. The interface between thyroid and diabetes mellitus. *Clin Endocrinol.* 2011;75:1–9. [PubMed] [Google Scholar]
6. Perros P, McCrimmon RJ, Shaw G, Frier BM. Frequency of thyroid dysfunction in diabetic patients: Value of annual screening. *Diabet Med.* 1995;12:622–7. [PubMed] [Google Scholar]
7. Wang C. The relationship between type 2 diabetes mellitus and related thyroid diseases. *J Diabetes Res.* 2013;2013:3905 34. [PMC free article] [PubMed] [Google Scholar]
8. Jali MV, Kambar S, Jali SM, Pawar N, Nalawade P. Prevalence of thyroid dysfunction among type 2 diabetes mellitus patients . *Diabetes Metab Syndr.* 2017;11(Suppl 1): S105–8. [PubMed] [Google Scholar]
9. Ozair M, Noor S, Raghav A, Siddiqi SS, Chugtai AM, Ahmad J. Prevalence of thyroid disorders in north Indian type 2 diabetic subjects: A cross sectional study. *Diabetes Metab Syndr.* 2018;12:301–4. [Pub Med]][Google Scholar]
10. Diez JJ, Sanchez P, Iglesias P. Prevalence of thyroid dysfunction in patients with type 2 diabetes. *Exp Clin Endocrinol Diabetes.* 2011 ;119:201–7. [PubMed] [Google Scholar]
11. Elgazar EH, Esheba NE, Shalaby SA, Mohamed WF. Thyroid dysfunction prevalence and relation to glycemic control in patients with

type 2 diabetes mellitus. *Diabetes Metab Syndr*. 2019;13:2513–7. [PubMed] [Google Scholar]

12. Al-Geffari M, Ahmad NA, Al-Sharqawi AH, Youssef AM, Alnaqeb D, Al-Rubeaan K. Risk factors for thyroid dysfunction among type 2 diabetic patients in a highly diabetes mellitus prevalent society. *Int J Endocrinol* . 2013; 2013:417920. [PMC free article] [PubMed] [Google Scholar]
13. Radaideh AR, Nusier MK, Amari FL, Bateiha AE, El-Khateeb MS, Naser AS, et al. thyroid dysfunction in patients with type 2 diabetes mellitus in Jordan. *Saudi Med J*. 2004;25:10 46–50. [PubMed] [Google Scholar]