

A Prospective Study of Thyroid Dysfunctions in Patients with Diabetes Mellitus

Sangita Parikh¹, Zalak Gadani², Kaushika Chaudhari³, Brinda Mevada⁴

¹Associate Professor, Department of General Medicine, AMC MET Medical College, Ahmedabad, Gujarat, India

²Associate Professor, Department of General Medicine, AMC MET Medical College, Ahmedabad, Gujarat, India

³Associate Professor, Department of General Medicine, AMC MET Medical College, Ahmedabad, Gujarat, India

⁴Associate Professor, Department of General Medicine, Smt NHL Municipal Medical College, Ahmedabad, Gujarat, India

Received: 15-04-2022 / Revised: 29-04-2022 / Accepted: 07-05-2022

Corresponding author: Dr Brinda Mevada

Conflict of interest: Nil

Abstract

Background: Diabetes Mellitus and thyroid dysfunctions are two most common endocrine disorders in clinical practice. The unrecognized thyroid dysfunctions may adversely affect the metabolic control.

Objective: The objective of study is to find out presence of thyroid dysfunctions in patients with type 1 and type 2 DM.

Method: This is a cross sectional observational type of study in which 204 patients with type 1 and type 2 DM were enrolled. All patients underwent a clinical and a laboratory evaluation. Patients were evaluated for thyroid profile and classified in subgroups as Euthyroid, Sub clinical hypothyroid, Overt hypothyroid, and hyperthyroidism.

Results: The thyroid dysfunction was found in 33.3% of diabetic patients. Most frequent thyroid dysfunction was sub clinical hypothyroidism which was 26.4 %, followed by overt hypothyroidism in 4.9 %. Hyperthyroidism was found in 1.96%.

Conclusion: Present study showed presence of thyroid dysfunction in diabetic patients suggesting that routine screening of all diabetics for thyroid profile to prevent metabolic complications and improve quality of life.

Keywords: Diabetes Mellitus, Hypothyroid, Hyperthyroid

This is an Open Access article that uses a fund-ing model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Background

Thyroid and diabetes are two most common endocrine disorders. Both influence each other and association between both conditions have been reported. On one hand thyroid hormones contribute to the regulation of carbohydrate metabolism and

pancreatic function. On other hand diabetes affect thyroid function test to variable extent. The relationship between thyroid and diabetes is characterised by complex interdependent interaction. Prevalence of thyroid disease in general population is

6.6%, while in diabetes, overall prevalence is 10.8-13.4%. [1] In hyperthyroidism, half-life of insulin is reduced secondary to increased rate of degradation and increased release of inactive insulin precursors causing hyperglycaemia. Untreated hyperthyroidism is associated with decrease in ratio of c-peptide to proinsulin suggestive of defect in proinsulin processing. Hyperthyroidism is associated with increased gut glucose absorption. Endogenous glucose production is also influenced by hyperthyroidism due to following mechanisms. [1]

- Increased GLUT2 concentration causing glucose transport in liver
- Increased lipolysis causing increased release of FFA, which stimulate gluconeogenesis
- Increased non oxidative glucose disposal causing overproduction of lactate, which enter in cori cycle to promote hepatic gluconeogenesis.
- Increase in GH, Glucagon, and catecholamine promote gluconeogenesis.

In hypothyroidism, there is decreased rate of production of glucose, so decrease in insulin requirement in diabetic patients. In patients with type 1 DM, with hypothyroidism both subclinical and overt, recurrent hypoglycemic attacks are more frequent. Hypothyroidism is also associated with insulin resistance, impairing insulin stimulated glucose utilization in peripheral tissue. Hypothyroidism is also associated with increased risk of metabolic syndrome. Increased frequency of retinopathy and neuropathy observed in diabetic patients with subclinical hypothyroidism.

In diabetic patients peak of TSH is blunted or abolished and TSH response to TRH is impaired. Diabetes is associated with "Low T3 syndrome" is characterized by isolated low T3 with normal T4 and TSH level. It is due to impaired peripheral conversion from T4 to T3, which normalize with improvement in glycemic control [2].

This study was conducted to understand this interdependent relationship between thyroid disease and diabetes and to guide clinicians on optimal screening and management of each disease.

Aims and objectives

1. To study thyroid function in patients with type 1 and type 2 diabetes mellitus.
2. To know the spectrum of thyroid dysfunction in type 1 and type 2 diabetes mellitus.

Materials and methods

Study Design: Observational Cross-sectional study

Study Duration: Study was started on September 2017 to August 2019

Study Area: Medical wards and OPDs of tertiary care hospital, Ahmedabad

Inclusion criteria: All the patients attending to

- Outpatient department and those patients admitted to ward having
- Type 2 DM longer than 6 months and type 1 DM longer than 1 year.

Exclusion criteria:

- Age < 18 years
- Pregnancy
- Patients with known case of thyroid dysfunction and on treatment
- Patients on drugs like steroids or amiodarone (more than 6-month duration) pancreatitis

Method:

This study was conducted at tertiary care hospital Ahmedabad, Gujarat State. The patients attending medical OPDs or admitted in medical wards were enrolled in study after considering the inclusion and exclusion criteria. Predesigned and pretested proforma was used to collect data from all patients. Routine parameters including BMI, blood pressure was recorded. Routine investigations like blood counts, blood sugar, serum electrolytes,

complete urine examination, Electrocardiogram (ECG), X-ray chest etc were done. TSH, free T4 level, FBS, PPBS, HBA1c will be carried out in all patients. Other special investigations like Anti TPO antibody and USG neck were carried out if required.

Thyroid dysfunction was classified as

- Clinical hypothyroidism: TSH > 4.2 microIU/ML and Ft4 < 0.93 Ng/ML
- Subclinical hypothyroidism: TSH > 4.2 microIU/ML and FT4 between 0.93-1.7 Ng/ML
- Subclinical hyperthyroidism: TSH < 0.27 microIU/ML and FT4 between 0.93-1.7 Ng/ML
- Clinical hyperthyroidism: TSH < 0.27 microIU/ML and T4 > 1.7 Ng/ml
- Auto immune thyroiditis: Anti TPO > 34 IU/ML

- Positive antibody titre with euthyroid state is not considered as criterion of thyroid dysfunction.

Results

Table 1 shows age distribution of patients. Out of total 204 patients, 7 patients had type 1 diabetes. Most commonly affected age group for type 1 diabetes was from 20-29 years. Total 197 patients had type2 DM. most commonly affected age groups were 50- 59 years (n=62), followed by 60-69 years (n=57), followed by 40-49 years (n=47). Mean age for type 1 DM was 26.71 ± 5.54 years and for type 2 DM was 54.13 ± 10.32 years.

Out of total 204 patients, 111 (54.41%) were female and among them 2 female patients had type 1 DM and 109 had type 2 DM. Total male patients were 93 (45.59%), among them 5 male patients had type 1 DM and 88 had type 2 DM.

Table 1: Age wise distribution of diabetic patients

Age group (years)	Type 1 DM (n=7)	Type 2 DM (n=197)
20-29	6	1
30-39	1	15
40-49	0	47
50-59	0	62
60-69	0	57
70-79	0	13
80-89	0	2
Mean+_ SD	26.71+_5.54	54.13+_10.32

Out of total 204 patients, 136 (66.67%) patients were euthyroid and maximum patients (n=85) fell in age group 50-69 years. Subclinical hypothyroidism was found in total 54 (26.47%) patients and maximum patients (n=32) fell in age group 40-59 years. Overt hypothyroidism was found in total 10 (4.9%) patients and maximum patients (n=4) in 40 -50 years of age group. Hyperthyroidism was found in 4 (1.96%) patients (table 2). Out of 111 female patients, 77 patients were euthyroid, 24 had subclinical hypothyroidism, 7 had overt hypothyroidism and 3 patients had hyper-

thyroidism. Out of 93 male patients, 59 patients were euthyroid, 30 had subclinical hypothyroidism, 3 had overt hypothyroidism and 1 patient had hyperthyroidism. Out of 7 patients with type 1 DM, 4 patients were euthyroid, 2 patients had subclinical hypothyroidism, 1 patient had overt hypothyroidism, and none had hyperthyroidism. Out of 197 patients of type 2 diabetes, 132 patients were euthyroid, 52 patients had subclinical hypothyroidism, 9 patients had overt hypothyroidism and 4 patients had hyperthyroidism.

Table 2: Thyroid profile in different age groups in diabetic patients

Age group	Euthyroid	SCH	Overt hypothyroidism	Hyperthyroidism	Total
20-29	3	3	1	0	7
30-39	13	2	0	1	16
40-49	29	13	4	1	47
50-59	40	19	2	1	62
60-69	45	10	1	1	57
70-79	6	5	2	0	13
80-89	0	2	0	0	2
Total	136 (66.67%)	54 (26.47%)	10 (4.9%)	4 (1.96%)	204

Total 131 patients have duration of diabetes < 6 years, out of which 43 (32.8%) have thyroid dysfunctions. Total 99 patients have duration of diabetes >6 years, out of which 51 (51.51%) have thyroid dysfunction (table 3).

Table 3: Duration of diabetes and thyroid profile

Duration in years	Euthyroid	SCH	Overt hypothyroidism	Hyperthyroidism	Total
< 6	88	34	6	3	131
6-10	38	14	2	0	54
>10	10	6	2	1	19
Total	136	54	10	4	204

Out of 204 patients, total 5 patients were underweighted, 72 patients had normal BMI and 87 patients had BMI between 25-30 and 38 patients had BMI >30. Total 124 patients fell in category of obese and overweight. Maximum patients of subclinical and overt hypothyroidism fell in category of BMI 25-30.

Table 4: BMI and thyroid profile in diabetic patients

BMI (kg/m ²)	Euthyroid	SCH	Overt hypothyroidism	Hyperthyroidism	Total
<18	3	2	0	0	5
18-24.9	54	15	3	0	72
25-30	53	23	6	4	86
>30	26	14	1	0	41
Total	136	54	10	4	204

Out of 204 patients, 154 patients had HbA1C >7 (uncontrolled diabetes), out of them 105(68.1%) patients were euthyroid, 39(25.3%) patients had subclinical hypothyroid, and 6(3.9%) patients had overt hypothyroidism and hyperthyroidism (table 5).

Table 5: HbA1C and thyroid profile in diabetic patients

HbA1C (%)	Euthyroid	SCH	Overt hypothyroidism	Hyperthyroidism	Total
<7	31	15	4	0	50
7-9	46	26	2	2	76
>9	59	13	4	2	78
Total	136	54	10	4	204

Discussion

Type 2 diabetes mellitus (DM) is a growing problem in our country, and we have observed that many patients are associated with thyroid dysfunction later in their life. The coexistence of thyroid dysfunction in diabetes patients will worsen micro and macrovascular complications and ultimately affect overall morbidity and mortality. Aim of this study was study spectrum of thyroid dysfunction in DM patients who attended the diabetic clinic from September 2019 to August 2021. Thyroid function tests were done in patients without history of previous thyroid dysfunction. Total 204 patients of DM were enrolled in this study, out of which 7 patients had type 1 DM and 197 patients had type 2 DM. Mean age in type 1 DM in our study was 26.17 ± 5.54 years. Type 1 DM is usually associated with absolute insulin deficiency and usual age of presentation is <30 years. Mean age in type 2 DM in our study is 54.13 ± 10.32 . In Type 2 DM, main pathophysiology is insulin resistance and abnormal secretory patterns of insulin. Out of total 204 patients, female patients were 111 and male patients were 93. Out of total 204 patients, 68 patients (33.33%) had abnormal thyroid profile. Among them 54 patients had subclinical hypothyroidism, 10 patients had overt hypothyroidism and 4 had hyperthyroidism. In study by Kamran Ali et al also reported prevalence of thyroid disorders about 25.7% in both type 1 and 2 DM.[3]

Subclinical and overt hypothyroidism is two most common form of thyroid dysfunction in type 2 DM. The prevalence of hypothyroidism in type 2 DM ranges from 6% to 20%. This wide range could reflect differences in age, sex and iodine intake in populations. In our study SCH was found in 26.4% and overt hypothyroidism was found in 4.9% which is slightly higher. Female sex, old age, TPO AB positivity and hospitalization are associated with increased risk of hypothyroidism, which

may be the reason for differences of prevalence of hypothyroidism in our study with other studies.

Most of the patients with altered thyroid profile were concentrated in age group from 40- 60years, suggesting that with increasing age, there are high chances of having abnormal thyroid profile. Out of 68 patients with abnormal thyroid profile, 40 patients fell in that age group. The result of this study is in accordance with the previous studies of Michalec *et al*, Whitehead *et al*, Feely *et al*, Vondra *et al*, Moulik *et al*, and Johnson *et al*, who also found high prevalence of thyroid disorders with advancing age in diabetic patients.[4-8] Out of total 111 female patients, 34(30.6%) patients and among 93 male patients, 34(36.15%) had thyroid dysfunction. Although thyroid dysfunction is more common in females, occurrence of both DM and thyroid function together found to be more common in males. Similar findings also observed in a study by Kamran ali etal, in which male patients had higher (29.2%) occurrence of thyroid dysfunction than female patients (23.7%) with DM. [3]

Among 7 patients of type 1 DM, 3 patients (42.85%) and out of 193 type 2 DM patients, 65 patients (33.67%) had thyroid dysfunction. Thyroid disorders are found more common in patients with type 1 DM as compared to type 2 DM. Among patients with type 1 DM, thyroid autoimmunity is strongly associated with thyroid dysfunction. The coexistence of two is explainable due to well-known fact that both disorders share auto immune etiology. [9] Occurrence of thyroid disorders was more in diabetics with duration of diabetes >6 years (51.51%) as compared to duration of DM <5 years (32.8%). Thus, we found that the prevalence of thyroid disorder was significantly associated with duration of DM. Similar result is also observed in the study of Telwani AA *et al* [10].

In our study, thyroid disorder in diabetics

was more in patients with BMI >25, (38.7%) as compared to patients with BMI <25 (25.9%) which is consistent with the results of the study by Telwani AA *et al.* [10] Obesity is significantly associated with thyroid dysfunction. This may be due to link between leptin and obesity. Leptins regulate TRH gene expression in paraventricular nucleus. Iodine deficiency, autoimmune thyroiditis, mutation in TSH receptors is some of other hypothesis to explain the association between TSH and obesity. [9] Elevated HBA1C is 4.3 times more likely to develop thyroid dysfunction than their counterpart with good glycemic control (HBA1C <7). [10]

Conclusion

The present study showed an association between thyroid dysfunctions in patients with DM. Hence screening for thyroid dysfunction in diabetic patients should be performed routinely, so as to recognise this dysfunction early, thus helping in improving quality of life and reducing morbidity.

References

1. Biondi B, Kahaly GJ, Robertson RP. Thyroid dysfunction and diabetes mellitus: two closely associated disorders. *Endocrine reviews*. 2019 Jun;40(3):789-824.
2. Mirella Hage, Mira S. Zantout, Sami T. Azar, Thyroid Disorders and Diabetes Mellitus, *Journal of Thyroid Research*.2011. Available from: <https://www.hindawi.com/journals/jtr/> 2011/439463/ [Accessed on 12 Jan 2022]
3. Kamran ali shajid ali shah, syed murtaza ali, raja jibran akbar, syed qasim raja, sadia kadir. Effect of age, gender and duration of diabetes mellitus on thyroid dysfunction in patients of Diabetic. *Pak armed Forces medical Journal*. 2021; 71(3): 853-6
4. Michalek AM, Mahoney MC, Calebaugh D. Hypothyroidism and diabetes in American Indian populations. *J Family Practice*. 2000;49(7):53-5.
5. Whitehead Clunt, Paerson F, Cawood TJ, Is Screening for hypothyroidism in diabetic clinic effective? *Practical diabetes*. 2010;27(3):113-7.
6. Vondra K, Virbikova J, Dvorakova K, thyroid gland disease in adult patients with diabetes mellitus. *Minerva Endocrinol*. 2005;30,217-36.
7. Moulik PK, Nethaji C, K Haleeli AA. Thyroid dysfunctions in Diabetes mellitus. Can we justify routine screening? *Endocrine Abstracts*. 2002; 3:292.
8. Johnson JL, Diabetes and thyroid disease: a likely combination. *Diabetes spectrum*. 2002;15:140-2
9. Shah SN Thyroid disease in diabetes Mellitus *J Assoc Physicians India*. 1984;32(12);1057-9
10. Ajaz Ahmed Telwani, Zahid Hussain Wani, Younis Asharf, Azaz Ahmed Shah, *International journal of research in medical sciences* .2017 ;5 (10): 4527-31