

Original Research Article

Study of thyroid dysfunction in type 2 diabetes mellitus

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ABSTRACT

Background: Aim was to study prevalence of thyroid dysfunction in type II diabetes mellitus (T2DM) patients.

Methods: The present study was a cross sectional observational study, which focused on cases of diabetes mellitus. Study was conducted in Departments of Medicine, SBKS MI & RC, a tertiary care centre for a period of 6 months. All the patients of T2DM were included. Total of 263 patients were enrolled which involved indoor, outpatient and diabetic clinic attending patients. A detailed history taking, clinical examination and relevant investigations (Hb%, Total count, platelet count, serum creatinine, FBS, PP2BS, HbA1C, S.TSH, F.T3 and F.T4). Appropriate statistical analytics were used and important correlations and conclusions were drawn.

Results: A study of thyroid dysfunction (TD) in T2DM patients which included 263 diabetic patients, out of them 67 had thyroid dysfunction. Out of these 67 patients 43 were female and 24 were male. This suggests that female was more prone to thyroid dysfunction than males. Out of 67 TD patients, 42 were above the age of 50 year. So, as the age increases the prevalence of TD also increases thyroid dysfunction also depends on the glycaemic control of the patients. Out of 67 patients 22 patients had >8.0 HbA1C level. In our study we found that as the glycaemic control became poorer the prevalence of TD increase in hypothyroid but not in hyperthyroidism.

Conclusions: Following conclusions were drawn from this study TD is more common in female than male, more after the age of 50 year, in T2DM patients. Hypothyroidism is more common with poor glycaemic control and long duration of T2DM patients. But for hyperthyroidism data which we evaluated was not significant and further conclusion bigger study is needed.

Keywords: Diabetes mellitus type 2, Hyperthyroidism, Hypothyroidism

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a chronic metabolic syndrome, which is characterized by chronic hyperglycaemia with disturbance in carbohydrate, fat and protein metabolism and related to deficiency in insulin secretion or due to peripheral resistance to insulin at cellular level.^{1,3-5} Some pathogenic processes and complex interactions between genetic and environmental factors are involved in genesis of T2DM.² These range

from autoimmune destruction of the beta cells of the pancreas with consequent deficiency of insulin secretion to abnormalities that result in resistance to insulin action at cellular level.^{1,4} Complete or near-complete insulin deficiency results in type 1 DM whereas type 2 DM is a heterogeneous group of disorders characterized by variable degrees of insulin resistance, impaired insulin secretion and increased glucose production.⁷

The physiological and biochemical inter relationship between insulin and thyroid hormones and the influence

of both insulin and iodothyronines on the metabolism of other carbohydrates, proteins and lipid indicate that iodothyronines are insulin antagonist with high levels being diabetogenic while absence of the hormone inhibits the development of diabetes.^{5,9} Investigation of the thyroid functions includes measurement of secretions (hormones) of the gland such as iodothyronine, carrier protein levels, trophic hormone such as thyroid stimulating hormone (TSH) and releasing hormone e.g. thyroxin releasing hormone (TRH).

The effects of iodothyronine on the various metabolic pathways are assessed by specific tests, such as free T4, free T3 and TSH.^{8,9,10,13}

Studies comparing the incidence of specific thyroid dysfunction (TD) between type 1 and type 2 diabetic patients show different inferences i.e. general consensus is TD is more prevalent among patients with type 2 diabetes mellitus, although some studies show a greater prevalence in type 1 DM; with female prevalence higher than males, proportionate increment of TD with age of onset, longer duration of diabetes, poorer glycaemic control and with patients having relatively higher abnormal body mass index and other co-morbid states like cardiovascular diseases namely hypertension, atherosclerosis and obesity.^{12,14,15} Also just like in general population, in diabetics as well TD can occur either as subclinical hypothyroidism (SCH) or hypothyroid or less commonly as hyperthyroid, although the state of euthyroid being more common than TD itself.^{10,11,16} Thus, in our study we aim to study the prevalence of thyroid dysfunction in patients with diabetes with a view to only enhance the already existing knowledge in this arena.

METHODS

A cross-sectional study of 263 individuals was conducted in Dhiraj Hospital, Vadodara, Gujarat. It included indoor, outdoor and diabetic clinic's patients, coming to Dhiraj hospital in a duration of one and half year from April 2018 to October 2019.

Study design

Observational cross-sectional study.

Case definition

Diabetes mellitus

Any patient with random blood glucose of more than 200 mg/dl or fasting glucose more than 126 mg/dl OR 2-hour post-prandial glucose more than 200 mg/dl OR HbA1C value of more than 6.5% was taken as diabetes mellitus.

Thyroid dysfunction

Primary hypothyroidism: When T3 and T4 are less than, and S. TSH levels are more than the normal range.

Primary hyperthyroidism: When T3 and T4 are more than, and S. TSH levels are less than the normal range.

Subclinical hypothyroidism: When T3 and T4 are normal and S. TSH is more than the normal range.

Subclinical hyperthyroidism: When T3 and T4 are normal and S. TSH is less than the normal range.

Normal ranges include S. TSH (0.39–5.0 micro IU/ml), free T3 (0.79–1.58 ng/ml), free T4 (4.00–11.00 mcg/ml)

Inclusion criteria

Inclusion criteria were all patients of T2DM who gave written informed consent.

Exclusion criteria

Exclusion criteria were all DM type 1 patient, patient who below age of 18 years, pregnant women and patient who are taking thyroid hormones affecting drugs (like: glucocorticoids, oral contraceptives, lithium)

All adult patients of diabetes mellitus attending Dhiraj hospital and who gave informed written consent would be subject for this study. All these patients were investigated for haemoglobin (Hb%, total count, platelet count), serum creatinine, FBS, PP2BS, HbA1C, thyroid Profile (S.TSH, F.T3 and F.T4).

Thus, every patient had been given informed consent and all the inclusion criteria as mentioned above were ensured. This was followed by relevant history taking, clinical examination and relevant investigations.

As mentioned previously individuals who were already a known case of thyroid disorder, who are on drugs that can affect the thyroid status who were comatose or unable to give consent due to any reason were carefully excluded from the study.

Outcome measures

Prevalence of thyroid dysfunction in the target population and to classify its type into primary hypothyroid, hyperthyroid, subclinical hyperthyroid and subclinical hypothyroid; prevalence of thyroid dysfunction and its sub-types in both males and females; prevalence of thyroid dysfunction and its sub-types in patients of DM of different age groups and having different degree of glycaemic control.

RESULTS

This study shows prevalence of thyroid dysfunction in different age group. In age of 40 to 50 years 15 (5.70%) patients are hypothyroidism, 77 (29.28%) patients are euthyroid, 6 (2.28%) patients are subclinical hypothyroidism, 4 (1.52%) patients are hyperthyroidism.

In age of 51 to 60 years 9 (3.42%) patients are hypothyroidism, 1 (0.38%) patients are subclinical hyperthyroidism, 68 (25.86%) patients are euthyroid, 5 (1.90%) patients are subclinical hypothyroidism, 4 (1.52%) patients are hyperthyroidism. In age of 61 to 70 year 12 (4.56%) patients are hypothyroidism, 4 (1.52%)

patients are subclinical hyperthyroidism, 39 (14.83%) patients are euthyroid, 3 (1.14%) patients are subclinical hypothyroidism. In age of 71 to 80 year 3 (1.14%) patients are hypothyroidism, 12 (4.56%) patients are euthyroid, 1 (0.38%) patients are subclinical hypothyroidism (Table 1).

Table 1: Prevalence of thyroid dysfunction according to age group in a patient T2DM.

Age group	40-50 years (%)	51-60 years (%)	61-70 years (%)	71-80 years (%)	P value
Hypothyroidism	15 (5.70)	(3.42)	12 (4.56)	3 (1.14)	0.516
Subclinical hypothyroidism	6 (2.28)	(1.90)	3 (1.14)	1 (0.38)	
Euthyroid	77 (29.28)	6(25.86)	39 (14.83)	12 (4.56)	
Subclinical hyperthyroidism	0 (0.00)	(0.38)	4 (1.52)	0 (0.00)	
Hyperthyroidism	4 (1.52)	4 (1.52)	0 (0.00)	0 (0.00)	
Total	102 (38.78)	87 (33.08)	58 (22.05)	16 (6.08)	

In the present study shows Female have higher prevalence of TD than male. P value is 0.005 which was statistically significant, which indicates that females are more prone to develop thyroid dysfunction than male (Table 2).

Table 2: Prevalence of thyroid dysfunction according to gender distribution in a patient of T2DM.

Gender	Euthyroid (%)	Thyroid dysfunction (%)	P value
Male	110 (41.83)	24 (9.12)	0.005
Female	86 (32.70)	43 (16.35)	
Total	196 (74.50)	67 (25.74)	

Table 3: Thyroid dysfunction in male and female according different age group in a patient of T2DM.

Age group (in years)	Euthyroid		Thyroid dysfunction	
	Male (%)	Female (%)	Male (%)	Female (%)
40-50	37 (14.07)	40 (15.21)	9 (3.42)	16 (6.08)
51-60	46 (17.49)	22 (8.37)	4 (1.52)	15 (5.70)
61-70	19 (7.22)	20 (7.60)	9 (3.42)	10 (3.80)
71-80	8 (3.04)	4 (1.52)	2 (0.76)	2 (0.76)
Total	110 (41.83)	86 (32.70)	24 (9.13)	43 (16.35)

In this study shows that there is a maximum prevalence of thyroid dysfunction in the age group of 61-70 years (32%). But the prevalence of thyroid dysfunction in the age group of 41-50, 51-60 and 71-80 is 24%, 21% and 25% respectively (Table 3).

In present study, total prevalence of thyroid dysfunction is 67 (25.47%) in all 263 T2DM patients.

Table 4: Prevalence of thyroid dysfunction in a patient of T2DM.

Thyroid dysfunction	N	%
Hypothyroidism	39	14.83
Subclinical Hypothyroidism	15	5.70
Euthyroid	196	74.52
Subclinical Hyperthyroidism	5	1.90
Hyperthyroidism	8	3.04
Total	263	100.00

Table 5: Glycaemic control of T2DM with thyroid dysfunction

HbA1C	Thyroid Dysfunction (%)	Euthyroid (%)	P value
<6.5	4 (66.66)	2 (33.33)	0.01
6.5-8	26 (23.63)	84 (76.36)	
>8	36 (24.65)	110 (75.34)	
Total	67 (25.47)	196 (74.52)	

Shows that hypothyroidism is most common thyroid dysfunction amongst the patients of T2DM. Second is subclinical hyperthyroidism with prevalence rate of 15 (5.70%), third is hyperthyroidism with prevalence rate of 8 (3.04%) and subclinical hypothyroidism is least common with 5 (1.90%) (Table 4).

Study shows the relationship between the level of HbA1C in T2DM patient with TD The table is suggestive of increase in TD in patients of T2DM with increase in the HbA1C level compared to euthyroid population. And this data is statistically significant with p value of 0.01.

It suggests that as the HbA1C level increases, the prevalence of TD increases (Table 5).

This Study shows relationship between glycaemic control of T2DM with thyroid dysfunction. Patients having glycaemic control (HbA1C) <6.5 are 6 in number, out of 6 patients 2(33.33%) are hypothyroid and euthyroid, 1(16.66%) is hyperthyroid and subclinical hypothyroid. Patients having glycaemic control (HbA1C) 6.5 to 8.0 are Total 120 in number, out of 120 patients 15 (13.63%) having hypothyroidism, 4 (3.63%) having subclinical hyperthyroidism, 84 (73.63%) are euthyroid, 6 (5.45%) having subclinical hypothyroidism, 2 (1.81%) having

hyperthyroidism. Patients having glycaemic control (HbA1C)>8.0 are 137 in number, out of 137 patients 22 (15.06%) having hypothyroidism, 1 (0.68%) having subclinical hyperthyroidism, 110 (75.34%) are euthyroid, 8 (5.47%) having subclinical hypothyroidism, 5 (3.42%) having hyperthyroidism. It suggests that there is no significant change in prevalence of hyperthyroidism as the HbA1c level increases but there is significant increase in prevalence of hypothyroidism as the HbA1c level increases (Table 6).

Table 6: Prevalence of various thyroid disorders with glycaemic control range.

HbA1C	Hypothyroidism (%)	Subclinical hypothyroidism (%)	Euthyroid (%)	Subclinical hyperthyroidism (%)	Hyperthyroidism (%)
<6.5	2 (33.33)	1 (16.66)	2 (33.33)	0 (0.00)	1 (16.66)
6.5-8	15 (13.63)	6 (5.45)	84 (73.63)	4 (3.63)	2 (1.81)
>8	22 (15.06)	8 (5.47)	110 (75.34)	1 (0.68)	5 (3.42)
Total	39 (14.83)	15 (5.70)	196 (74.52)	5 (1.90)	8 (3.04)

DISCUSSION

In present study, 263 patients of T2DM were evaluated, out of which 134 (50.95%) were male and 129 (49.05%) were female. Out of 263 patients, 196 (74.50%) patients were euthyroid and 67 (25.74%) patients had thyroid dysfunction. Out of 67 patients 24 (9.12%) were male and 43 (16.35%) were female. In spite of a greater number of male diabetic patients TD was more common in female diabetic patients which suggests that female patients were more prone to TD than male patients. A similar study was done by Wani et al HIMSR, New Delhi, India, in which total 300 patients of T2DM were taken out of which 124 (41.33%) were male and 176 (58.67%) were female. Out of them 14 males and 38 females had TD.¹⁷

Out of 67 TD patients’ highest prevalence was 14.83% for hypothyroidism. Second highest prevalence was 5.70% for subclinical hypothyroidism. Third highest prevalence was 3.04% for hyperthyroidism. Least prevalence was 1.90% for subclinical hyperthyroidism. So according to our study T2DM patients were more prone to hypothyroidism rather than other entities of thyroid disorder. In most of the studies the prevalence of subclinical hypothyroidism is highest but, in our study, we found that hypothyroidism had highest prevalence. Being a tertiary care hospital, patients having clinical features of TD present to us. So, less patients of sub clinical hypothyroidism were found in our study. A similar study was done by Rehman et al in Jordan where highest prevalence of sub clinical hypothyroidism was 10 (8.06%), 2nd with sub clinical hyperthyroidism was 7 (5.6%), 3rd with hypothyroidism was 4 (3.2%), and the least prevalence with hyperthyroidism was 1 (0.8%).¹⁸

In our study we found that glycaemic control also affects thyroid dysfunction. With poor glycaemic control the prevalence of thyroid dysfunction had increase. In our

study out of 67 patients, 1.52% being in<6.5 HbA1C level, 9.88% being in 6.5-8.0 HbA1C level, 13.68% being in>8 HbA1C level. We also found that Prevalence of TD increase as the HbA1C level increase in hypothyroid patients but not in hyperthyroid patients.

In our study the sample size is less so for further evaluation a bigger study is recommended. Similar result was found in study of Singh et al at GMRC Gwalior Madhya Pradesh. If diabetic patient had poor glycaemic control than they were more prone to develop thyroid dysfunction.¹⁹

CONCLUSION

Thyroid dysfunction (TD) is more common in female than male in T2DM patients. TD occurs more after the age of 50 year in T2DM patients. Hypothyroidism is more common with poor glycaemic control and long duration of T2DM patients. But for hyperthyroidism data which we evaluated was not significant and for further conclusion bigger study is needed.

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