Original Research Article

A study of thyroid dysfunction in type 2 diabetes mellitus

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Abstract

Background: Diabetes Mellitus 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 in its action. Diabetes mellitus and hyperthyroidism are metabolic disorders that affect the levels of carbohydrates, proteins and lipids also. The effects of thyroid dysfunction on the various metabolic pathways are assessed by specific tests, such as free T4, free T3 and TSH.

Materials and methods: An observational 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 duration of one year.

Results: In this study, total number of patient was 263, in which 134 were male and 129 were female. Out of 263 patients, 196 were euthyroid. Out of 134 male, 110 were euthyroid and 24 had thyroid dysfunction and out of 129 female, 86 were euthyroid and 43 had thyroid dysfunction with prevalence of 9.12% and 16.35% respectively.

Conclusion: A study of thyroid dysfunction 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 were more prone to thyroid dysfunction than males. Out of 67 thyroid dysfunction patients, 42 were above the age of 50 year. So as the age increases the prevalence of thyroid dysfunction also increases. In our study, we found that as the duration of T2DM increases, the prevalence of thyroid dysfunction increases in patients of hypothyroidism but no such correlation was found in patients of hyperthyroidism.

Key words

Diabetes mellitus, Thyroid dysfunction, Euthyroid.

Introduction

Diabetes Mellitus (DM) is a chronic metabolic syndrome [1], which is characterized by chronic hyperglycaemia with disturbance in carbohydrate, fat and protein metabolism and related to deficiency in insulin secretion or in its action [1, 3, 5].

Insulin is secreted by the beta cells of islet of Langerhans of the pancreas in response to high blood glucose levels thereby lowering its level [1, 2]. Thus in DM either the deficiency in the secretion of insulin or due to the peripheral resistance at the cellular level, is what leads to hyperglycaemia [1, 4]. Some pathogenic processes and complex interactions between genetic and environmental factors are involved in its development of insulin [2]. These range from autoimmune destruction of the beta cells of the pancreas with consequent insulin deficiency to abnormalities that result in resistance to insulin action [1, 4].

DM is broadly classified into: Type 1 and Type 2 DM. 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 effects of diabetes mellitus include long term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, heart and blood vessels, these are diabetic foot, diabetic neuropathy, diabetic nephropathy and retinopathy, musculo-skeletopathies and endocrinopathies, all which worsen the condition in itself and add to its morbidity and mortality [4, 8]. Prevalence of T2DM is increasing globally and has reached epidemic proportions in many countries [6].

The physiological and biochemical interrelationship between insulin and thyroid hormones and the influence of both insulin and iodothyronines [5] on the metabolism of other carbohydrates, proteins and lipid, indicate that iodothyronines are insulin antagonist [5] with high levels being diabetogenic while absence of the hormone inhibits the development of diabetes [5, 9]. Diabetes mellitus and hyperthyroidism are metabolic disorders that affect the levels of carbohydrates, proteins and lipids also. 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].

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 [12, 15]; with female prevalence higher than males, proportionate increment of TD with age of onset, longer duration of diabetes, poorer glycemic 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]. 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].

Apparently diabetes in itself carries uncertain morbidity and mortality. Hence to determine the prevalence of clinical and subclinical thyroid diseases and other similar complications in the diabetic population and also to study their implications in the course of diabetes and on other known factors like cardiovascular risk becomes necessary [15].

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.

Materials and methods

An observational 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 duration of one year.

All adult patients of diabetes mellitus attended Dhiraj hospital and who gave informed written consent were enrolled for this study. All these patients were investigated for hemogolobin (Hb%, total count, platelet count), Serum Creatinine, FBS, PP2BS, HbA1C, thyroid profile (S.TSH, F.T3 and F.T4). Individuals who were already a known case of thyroid disorder, who were 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.

Statistical analysis

All data were collected from the target population and since our study is a cross-sectional study, the data was expressed in categorical variables and the derivation of our study was calculated in form of proportions and percentages.

Results

Prevalence of thyroid dysfunction according to age group was as per **Table – 1**. In this study, total number of patient was 263, in which 134 were male and 129 were female. Out of 263 patients, 196 were euthyroid. Out of 134 male, 110 were euthyroid and 24 had thyroid dysfunction and out of 129 female, 86 were euthyroid and 43 had thyroid dysfunction with prevalence of 9.12% and 16.35% respectively.

Female had higher prevalence of thyroid dysfunction than male. P value was 0.005 which was statistically significant, which indicates those females were more prone to develop thyroid dysfunction than male (**Table – 2**).

According to **Graph – 1**, out of 24 male patients, 14 had hypothyroidism, 5 had subclinical hypothyroidism, 4 had hyperthyroidism and 1 had subclinical hyperthyroidism with a prevalence of 5.32%, 1.90%, 1.52% and 0.38% respectively. Out of 43 female patients, 25 had hypothyroidism, 10 had subclinical hypothyroidism, 4 had hyperthyroidism and 4 had subclinical hyperthyroidism with a prevalence of 9.51%, 3.80%, 1.52% and 1.52% respectively.

Table - 1: Prevalence of thyroid dysfunction according to age group in patients of type 2 diabetes mellitus (T2DM).

Age group (Years)	40 to 50 (%)	51 to 60 (%)	61 to 70 (%)	71 to 80 (%)	P value
Hypothyroidism	15(5.70%)	9(3.42%)	12(4.56%)	3(1.14%)	0.516
Subclinical Hypothyroidism	6(2.28%)	5(1.90%)	3(1.14%)	1(0.38%)	
Euthyroid	77(29.28%)	68(25.86%)	39(14.83%)	12(4.56%)	
Subclinical Hyperthyroidism	0(0.00%)	1(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%)**	

Table - 2: Prevalence of thyroid dysfunction according to gender distribution in patients 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%)	

Graph - 1: Prevalence of thyroid dysfunction in male and female.

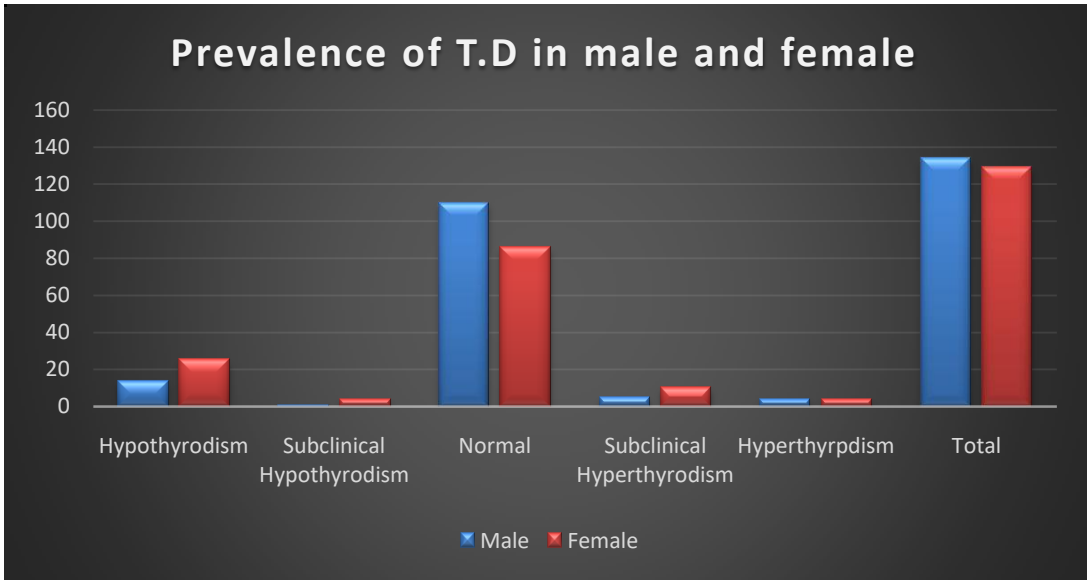

Table - 3: Prevalence of thyroid dysfunction in patients of T_2DM.

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 - 4: Duration of T2DM with thyroid dysfunction in male and female.

Duration of Diabetes Mellitus	Euthyroid		Thyroid dysfunction	
	Male	Female	Male	Female
<1 Year	0 (0.00%)	0 (0.00%)	3 (75%)	1 (25%)
1 to 5 Years	66 (45.83%)	48 (33.33%)	12 (8.33%)	18 (12.5%)
6 to 10 Years	28 (36.36%)	27 (35.06%)	4 (5.19%)	15 (19.48%)
11 to 15 Years	12 (40%)	8 (26.66%)	2 (6.66%)	8 (26.66%)
> 15 Years	4 (36.36%)	3 (27.27%)	3 (27.27%)	1 (9.09%)

Table - 5A: Duration of T_2DM with thyroid dysfunction.

Duration of DM	Thyroid dysfunction	Euthyroid	Total	P value
<1 Year	4 (100%)	0 (0.00%)	4 (100%)	0.02
1 to 5 Years	30 (20.83%)	94 (79.17%)	144 (100%)	
6 to 10 Years	19 (25.67%)	55 (74.32%)	74 (100%)	
11 to 15 Years	10 (33.33%)	20 (66.66%)	30 (100%)	
> 15 Years	4 (36.36%)	7 (63.63%)	11 (100%)	
Total	67 (100.00%)	196 (100.00%)	263	

Graph - 1 shows that males and females both were more prone to hypothyroidism than rest of the entities.

In present study, total prevalence of thyroid dysfunction was 67 (25.47%) in all 263 T_2DM patients. **Table - 3** shows that hypothyroidism was most common thyroid dysfunction amongst the patients of T2DM. Second was subclinical hyperthyroidism with prevalence rate of 15(5.70%), third was hyperthyroidism with prevalence rate of 8 (3.04%) and subclinical hypothyroidism was least common with 5(1.90%).

Table - 4 shows the relationship between duration of T2DM with thyroid dysfunction in male and female. Patients having duration of T2DM <1 years were 4 in number and out of 4 patients 3 male and 1 female had thyroid dysfunction Patients having duration of T2DM 1 to 5 years were 144 in number, 66 male and 48 female were euthyroid, 12 male and 18 female had thyroid dysfunction. Patients having duration of T2DM 6 to 10 years were 77 in number, 28 male and 27 female were euthyroid, 4 male and 18 female have thyroid dysfunction. Patients having duration of T2DM 11 to 15 years were 27 in number, 12 male and 8 female were euthyroid, 2 male and 5 female had thyroid dysfunction. Patients having duration of T2DM >15 years were 11 in number and, 4 male and 3 female were euthyroid, 3 male and 1 female had thyroid dysfunction. This indicated that the patients having T2DM since 6 to 15 years were more prone to develop T.D.

Table - 5B: Relationship between duration of T2DM with thyroid dysfunction.

Duration of T2DM (Years)	Hypothyroidism	Subclinical Hypothyroidism	Euthyroid	Subclinical Hyperthyroidism	Hyperthyroidism	P value
<1 Year	3 (75.00%)	1 (25.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0.020
1 to 5	19 (13.19%)	6 (4.17%)	114 (79.17%)	1 (0.69%)	4 (2.78%)	
6 to 10	10 13.51%)	5 (6.67%)	55 (74.32%)	3 (4.05%)	1 (1.35%)	
11 to 15	5 (16.67%)	2 (6.67%)	20 (66.67%)	1 (3.33%)	2 (6.67%)	
> 15	2 (18.18%)	1 (9.09%)	7 (63.64%)	0 (0.00%)	1 (9.09%)	
Total	**39 (14.83%)**	**15 (5.70%)**	**196 (74.52%)**	**5 (1.90%)**	**8 (3.04%)**	

Table – 5A shows the relationship between duration of T2DM with thyroid dysfunction. It shows that as the duration of diabetes increases, the prevalence of T.D also increases which is reflected as shown in the table above.In the duration of 1 to 5 years prevalence is 20.83%, in 6 to 10 years prevalence was 25.67%, in 11 to 15 years it was 33.33% and in >15 years it was 36.36%.

Table – 5B shows the relationship between duration of T2DM with thyroid dysfunction. Patients having T2DM duration with less than 1 year were 4 in number and out of 4 patients 3 (1.14%) patients had hypothyroidism, 1(0.38%) patient had subclinical hypothyroidism. Patients having DM II duration with 1 to 5 years were 144 in number and out of 144 patients 19(7.22%) patients had hypothyroidism, 1(0.38%) patient had subclinical hyperthyroidism, 114(43.35%) had euthyroid, 6(2.28%) patients had subclinical hypothyroidism, 4(1.5%) patients had hyperthyroidism. Patients having DM II duration with 6 to 10 years were 77 in number and out of 77 patients 10(3.80%) patients had hypothyroidism, 4(1.5%) patient had subclinical hyperthyroidism, 55(20.9%) had euthyroid, 6(2.28%) patients had subclinical hypothyroidism, 2(0.76%) patients had hyperthyroidism. Patients having DM II duration with 10 to 15 years were 27 in number and out of 27 patients 5(1.90%) patients had hypothyroidism, 20(7.60%) had euthyroid, 1(0.38%) patients had subclinical hypothyroidism and hyperthyroidism. Patients having DM II duration with more than 15 years

were 11 in number and out of, 11 patients 2(0.76%) patients had hypothyroidism, 7(2.66%) had euthyroid, 1(0.3%) patients had subclinical hypothyroidism and hyperthyroidism. P value was 0.020 which was statistically significant.

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 more number of male diabetic patients T.D was more common in female diabetic patients which suggest that female patients were more prone to T.D than male patients. A similar study was done by Bilal Wani, Mohammadd Ashraf Khan, et al. at 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 thyroid dysfunction [16].

Out of 67 thyroid dysfunction 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 thyroid dysfunction present to us. So less patients of sub clinical hypothyroidism were found in our study. A similar study was done by Abdel Rehman (MD), Mohamad K. Nushair, 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%) [17].

In our study, as the age and duration of T2DM increases, the prevalence of thyroid dysfunction increases as compared to euthyroid individual. Out of 67 thyroid dysfunction patients, 42 were above the age of 50 year (62.68%) and the mean age was 55.67. In duration of T2DM of 1 to 5 years, out of 124 patients 31% had thyroid dysfunction, in 6 to 10 years out of 77 patients 40% had T.D, in 11 to 15 years, out of 27 patients 35% had thyroid dysfunction in >15 years, out of 11 patients 57% had thyroid dysfunction. But we found that thyroid dysfunction increases as the duration of T2DM increases 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 the study conducted by Dr. Ajay Pal Singh and Dr. Runu Sharma, et al. at GMRC Gwalior Madhya Pradesh [18].

In our study, we found that glycemic control also affects thyroid dysfunction. With poor glycemic 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 thyroid dysfunction 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 Dr. Ajay Pal Singh and Dr. Runu Sharma, et al. at GMRC Gwalior Madhya Pradesh [18]. If diabetic patient had poor glycemic control than they were more prone to develop thyroid dysfunction.

Conclusion

A study of thyroid dysfunction 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 were more prone to thyroid dysfunction than males. Out of 67 thyroid dysfunction patients, 42 were above the age of 50 year. So as the age increases the prevalence of thyroid dysfunction also increases. In our study, we found that as the duration of T2DM increases, the prevalence of thyroid dysfunction increases in patients of hypothyroidism but no such correlation was found in patients of hyperthyroidism.

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