

Original Research Article

Prevalence of thyroid dysfunction in type 2 diabetes mellitus: a case control study

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ABSTRACT

Background: Diabetes mellitus and thyroid disorders are the most common endocrine disorders worldwide. Various studies have found that diabetes and thyroid disorders mutually influence each other and both disorders tend to coexist. So, we conducted a study to find out the prevalence of thyroid disorders in patients of type 2 diabetes mellitus.

Methods: This study was conducted on 100 diabetic patients and 100 controls. All the participants were evaluated for thyroid dysfunctions by testing thyroid profile. The correlation of prevalence of thyroid disorder with age distribution, gender distribution, BMI, duration of diabetes and HbA1C was then done.

Results: The prevalence of thyroid dysfunctions were high in diabetic patients compared to controls (29% versus 9%, P value <0.001). Most common thyroid disorder in diabetic patients was subclinical hypothyroidism (16%) while least common was hyperthyroidism (1%). The levels of serum T3 and T4 were significantly low while serum TSH levels were significantly high in diabetic group compared to control group. Prevalence of thyroid disorders in diabetics were significantly more in patients with age ≥ 50 years, more in females, more in patients with BMI ≥ 30 and more in patients with duration of diabetes ≥ 5 years. The association of prevalence of thyroid disorders with HBA1C was not significant.

Conclusions: Current study showed high prevalence of thyroid dysfunctions in diabetic patients. We conclude that screening for thyroid dysfunction among patients with diabetes mellitus should be routinely performed, so as to recognize these dysfunctions early.

Keywords: Diabetes mellitus, Thyroid Dysfunction, T3, T4, TSH

INTRODUCTION

Diabetes mellitus (DM), a leading cause of death worldwide, is the most common endocrine disorder.¹ It is characterized by persistent hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Development of diabetes involves several pathogenic processes ranging from autoimmune destruction of the β -cells of the pancreas with consequent insulin deficiency to abnormalities that result in resistance to insulin action.^{2,3} According to World Health Organization

(WHO), the worldwide prevalence of diabetes in 2002 was 170 million and the number projected to grow up to 366 million or more by 2030.⁴ Sedentary lifestyle, various diet patterns, ethnicity and a genetic predisposition are the major factors responsible for the causes of the epidemic.⁵

Thyroid disorders are also common in the general population and it is the second most common endocrine disorder. As a result, it is common for an individual to be affected by both thyroid disease and diabetes.⁶ Various

studies have reported the low prevalence of thyroid dysfunction among diabetic patients, between 2.2 to 17 % in their respective population.^{7,8} However, few studies have showed higher prevalence of thyroid dysfunction in diabetes from 31 % to 46.5 %.^{9,10}

Thyroid hormones and insulin are the antagonists and both are involved in cellular metabolism of carbohydrates, proteins, and lipids. The functional impairment occurs in thyroid hormone as well as insulin if their levels changed.¹¹ DM appears to influence thyroid function in two sites; firstly, at the level of hypothalamic control of TSH release and secondly at the conversion of T4 to T3 in the peripheral tissue. Hyperglycemia causes reversible reduction of the activity and hepatic concentration of T4-5-deiodinase, low serum T3, increase in reverse T3 and also variation in the level of T4.¹²

The diagnosis of thyroid dysfunction in diabetic patients based solely on clinical manifestations can be difficult because signs and symptoms of thyroid disorders are similar to those for diabetes and can be overlooked or attributed to other medical disorders. The recognition of this interdependent relationship between thyroid disease and diabetes is of importance to guide clinicians on the optimal management of both these conditions. The prevalence of thyroid dysfunctions in type 2 diabetes mellitus varies in literature from very low (5.5%) to very high (75%).^{8,13} Till date, there is no consensus regarding actual prevalence. So, the aim of this study was to find out the prevalence of thyroid dysfunction in type 2 diabetes mellitus.

METHODS

This prospective single center case control study was conducted in the department of medicine SKIMS medical college and hospitals Srinagar over a period of two years from July 2014 to July 2016. The study was approved by clinical research and ethics committee of institute. 100 cases of type 2 diabetes mellitus and 100 controls were taken into study. All the cases in diabetic group were confirmed diabetics who were on treatment for diabetes mellitus. Diagnosis of diabetes was done by ADA 2014 criteria. This criterion consists of A1C \geq 6.5%, FPG \geq 126 mg/dL, two-hour 75 gm PG \geq 200 mg/dL or random plasma glucose \geq 200 mg/dL with classic symptoms of

hyperglycemia. 100 healthy volunteers without history of diabetes, matched with cases based on age (\pm 2 Years) and sex were taken as controls.

Inclusion criteria for cases were diabetic patients on treatment, with no diabetic complications and no previous thyroid dysfunctions. Participants with other disorders like type 1 diabetes mellitus, renal diseases, liver diseases, pregnancy, critically ill patients and patients on drug therapy that affect thyroid function were excluded from study. All participants provided a signed informed consent. Data regarding the age, sex, weight, height, blood glucose, HbA1c, thyroid profile, lipid profile, LFT, blood urea and creatinine were collected from participants.

Fasting blood sample was taken for blood chemistry. Body mass index (BMI) was calculated as kg/m^2 . Normal range for thyroid hormones were taken as, T3 (77-135 ng/dL), T4 (5.4 -11.7 ug/dL) and TSH (0.34-4.25 mIU/L). Subclinical hypothyroidism was defined as an elevated TSH level with normal serum thyroid hormone levels. Hypothyroidism was defined as an elevated TSH together with a decreased serum thyroid hormone levels. Subclinical hyperthyroidism was defined as a decreased TSH with normal thyroid hormone levels and hyperthyroidism was defined as a decreased TSH with elevated thyroid hormone levels. The correlation of thyroid dysfunction in diabetic patients with age, sex, BMI, duration of diabetes, HbA1C, was then done. The observations and interpretations were recorded and results obtained were statistically analyzed.

Statistical analysis

Statistical analyses were performed by using SPSS 20 (IBM). Independent T Test was performed for continuous variables and chi square test for categorical variables. A value of $P \leq 0.05$ was considered statistically significant.

RESULTS

200 participants were taken into the study from OPD clinics. Thyroid dysfunctions were seen in 38 (19%) of participants. Thyroid dysfunctions were more in diabetic group compared to control group (29% versus 9%). This was statistically significant with P value < 0.001 .

Table 1: Thyroid dysfunctions in cases and controls.

Thyroid dysfunction	Diabetes (n=100)	Control (n=100)	P value	Remark
Sub clinical hypothyroidism	16 (16.0%)	5 (5.0%)	0.011	S
Hypothyroidism	10 (10.0%)	3 (3.0%)	0.045	S
Sub clinical hyperthyroidism	2 (2.0%)	1 (1.0%)	> 0.999	NS
Hyperthyroidism	1 (1.0%)	0 (0.0%)	> 0.999	NS
Total thyroid dysfunction	29 (29.0%)	9 (9.0%)	< 0.001	S

Values are presented as n (%), S - Significant, NS - Not Significant.

Subclinical hypothyroidism was more in diabetic group compared to control group (16% versus 5%, P value 0.011). Hypothyroidism was again more in diabetic group compared to control group (10% versus 3%, P value 0.045). Hyperthyroidism and subclinical hyperthyroidism were insignificantly more in diabetic group. Most common thyroid disorder in diabetic patients was

subclinical hypothyroidism (16%) while least common was hyperthyroidism (1%) (Table 1).

The levels of serum T3 and T4 were significantly low while serum TSH levels were significantly high in diabetic group compared to control group (Table 2).

Table 2: Hypothyroidism in cases and controls.

Thyroid function	Diabetes(n=100)	Control (n=100)	P value	Remark
T3	102.9±19.1	111.3±17.7	0.002	S
T4	7.5±3.7	8.8±4.4	0.020	S
TSH	5.2±3.1	3.4±1.4	<0.001	S

Values are presented as Mean±SD, S - Significant.

Prevalence of thyroid disorders in diabetics were significantly more in patients with age ≥ 50 years, more in females, more in patients with BMI ≥ 30 and more in

patients with duration of diabetes ≥ 5 years. The association of prevalence of thyroid disorders with HBA1C was not significant (Table 3).

Table 3: Correlation of thyroid dysfunctions in diabetics with Age, Sex, BMI, Duration, HBA1C.

Thyroid dysfunction, (N=29)	Age		Sex		BMI		Duration		HBA1C	
	≥50 year	<50 year	M	F	≥30	<30	≥5 year	<5 year	≥7	<7
	79.3%	20.7%	31%	69%	51.7%	48.3%	75.9%	24.1%	41.4%	58.6%
P Value	0.031		0.030		0.011		0.007		0.113	

DISCUSSION

Diabetes is a leading cause of morbidity and mortality worldwide. Its incidence is increasing day by day all over the world, posing a major threat to the public health. Thyroid disorders are also very common endocrine disorders in the general population. Hence it is common for an individual to be affected by both thyroid diseases and diabetes. The aim of this study was to evaluate the prevalence of thyroid dysfunctions in type 2 diabetic patients. In present study thyroid dysfunctions were found in 29% of diabetic patients. Similar results were reported by Ghazali et al, Gurjeet et al, Laloo et al and Diaz et al, who reported 29.7%, 30%, 31.2% and 32.4% respectively.¹⁴⁻¹⁷ However studies by Radaideh et al, Perros et al and Papazafiropoulou et al, showed lower prevalence (12.5%, 13.4% and 12.3% respectively) of thyroid dysfunctions in diabetic patients.^{7,18,19} Most prevalent thyroid disorder in diabetic patients was subclinical hypothyroidism occurring in 16%, followed by hypothyroidism in 10%, subclinical hyperthyroidism in 2%, and hyperthyroidism in 1%. Our results are in concordance with the results of Perros et al, Celani et al, Nobre et al, Babu et al and Radaideh et al.^{7,9,18,20,21}

Out of 29 diabetic patients who had thyroid dysfunctions, 79.3% of patients had age ≥ 50 years, 20.7% had age < 50 years. This was statistically significant, P value of 0.031. Thus, the prevalence of thyroid disorder was found to be higher in patients with more age. The results of present study are in accordance with the previous studies of Michalek 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 in diabetic patients with advancing age.²²⁻²⁷

In the present study, the prevalence of thyroid disorders was more in females as compared to males (69% versus 31%). This was statistically significant, P value of 0.030. Our results are consistent with studies of Papazafiropoulou et al, Celani et al, Vondra et al, Pimenta et al Babu et al and Michalek et al.^{9,19,21,22,25,28} Thus the prevalence of thyroid disorders in diabetic patients is influenced by female gender.

The prevalence of thyroid disorders in diabetics were more in patients with BMI ≥ 30 as compared to patients with BMI < 30 (51.7% versus 48.3%). This was statistically significant, P value of 0.011. Similar results were reported by Papazafiropoulou et al and Proces et al.^{19,29}

The prevalence of thyroid disorders was more in diabetics with duration of diabetes ≥ 5 years as compared to duration < 5 years (75.9% versus 24.1%). This was statistically significant, P value of 0.007. Thus, we found that the prevalence of thyroid disorders was significantly affected by duration of diabetes. However, study by Diez et al, found no significant relationship between presence of thyroid dysfunction and duration of diabetes.¹⁷

The prevalence of thyroid disorders in diabetics were more in patients with HBA1C < 7 as compared to patients with HBA1C ≥ 7 (58.6 % versus 41.4 %). This was statistically insignificant, P value of 0.113. Thus, we found that the prevalence of thyroid disorders was not affected by control (HBA1C) of diabetes. However, studies by Schlienger et al, Bazrafshan et al and Ardekani et al, found thyroid dysfunctions significantly higher in diabetics with higher HBA1C.³⁰⁻³²

CONCLUSION

This study showed high prevalence of thyroid dysfunctions in patients of type 2 diabetes mellitus. Hence, we conclude that screening for thyroid dysfunction among patients with diabetes mellitus should be routinely performed, so as to recognize these dysfunctions early. This will improve the quality of life and reduce the morbidity rate in them.

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