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How Thyroid Profile is Affected by Diabetic Mellitus: A Cross Sectional Study

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ABSTRACT

Background: Diabetes mellitus and thyroid illnesses are the two endocrine conditions that are seen in clinical practice the most frequently. Patients frequently have a tendency to suffer from both diabetes mellitus and thyroid dysfunction at the same time. This article illustrates why it is important to recognize the interdependent relationship that exists between thyroid illness and diabetes.

Method: Present study was conducted among 193 T2DM patients. Patients' last three-month glucose level was measured by HBA1c and thyroid dysfunction evaluated by thyroid profiling. Association and prediction of different variables for developing thyroid dysfunction among diabetic patients was calculated using chi-square, t test and ROC curve.

Result: Out of 193, 47 patients had thyroid dysfunction, majority 22(11.4%) had subclinical hypothyroidism. 13(6.7%) had Hypothyroidism, 6(3.1%) had subclinical Hyperthyroidism, 3(1.5%) had Hyperthyroidism and 3(1.5%) patients were euthyroid. The prevalence of established thyroid disease was higher in females 32 (68.1%). Out of 47 patients with thyroid dysfunction, 39(82.9%) patients had HBA1C >6.5%.

Conclusion: Age >50 years and female gender played as risk factor for developing thyroid dysfunction among patients with T2DM. HBA1C >6.5% and TSH more than 3.65mIU/L was independent risk factor for predicting thyroid dysfunction in T2DM.

INTRODUCTION

Diabetes mellitus and thyroid illnesses are the two endocrine conditions that are seen in clinical practice the most frequently. It has been established that diabetes and thyroid diseases can mutually influence one another, and links between the two conditions have been observed for a very long time.[1] On the one hand, thyroid hormones are involved in the control of glucose metabolism and pancreatic function. On the other hand, diabetes can have varying degrees of an effect on thyroid function tests.

There are multiple ways in which thyroid hormones might influence glucose metabolism. It has been known for a long time that hyperthyroidism can contribute to hyperglycemia. [2] The half-life of insulin is shortened during hyperthyroidism, most likely as a consequence of an accelerated rate of insulin breakdown and an augmented production of physiologically inactive insulin precursors.[3]

Thyroid diseases affect a very large population and have a prevalence that varies greatly depending on the population. Patients frequently have a tendency to suffer from both diabetes mellitus (DM) and thyroid dysfunction (TD) at the same time. Patients with type 2 diabetes mellitus (T2DM) are more likely to suffer from hypothyroidism and hyperthyroidism than their non-diabetic counterparts are to experience either condition. The most recent guidelines are neither clear nor explicit about how often people with type 2 diabetes should have their thyroid function monitored.[4]

Patients with type 2 diabetes should be screened for thyroid disease since all of the endocrinopathies and the complex interdependent connections between them raise the risk of cardiovascular disease. However, the monitoring of thyroid function in type 2 diabetes is not included at all in some guidelines, [5] while other guidelines support a thyroid function test at baseline but are against routine annual thyroid screening in T2DM. [6]

Recently, it was revealed that prevalence of thyroid disease among diabetic patients in Brazil was a 14.7%,[7] and in Saudi Arabia, prevalence of thyroid dysfunction was observed in 28% of type 2 diabetic patients with subclinical hypothyroidism among 18.8% as the commonest thyroid disorder [8] Both of these populations were shown to have thyroid dysfunction. According to the findings of a study carried out by M. V. et al.[9], 16.2% of type 2 diabetic patients exhibited symptoms of thyroid impairment.

With this background current study was done to find prevalence of thyroid dysfunction among type 2 diabetes mellitus patients. As such study is first of its kind in our tertiary care center. This article illustrates why it is important to recognize the interdependent relationship that exists between thyroid illness and diabetes, which in turn will help guide clinicians to perform the most effective screening and management of these conditions.

METHOD

Present study was conducted in Saraswathi institute of medical sciences after getting approval of protocol from the Ethical committee. According to Khassawneh et al[10] study finding,14% T2DM patients had a previous thyroid disease. Calculated sample sized based on prevalence of 14% with absolute error 5% was 193 based on formula $4pq/L^2$. Where, p is14%, q is 86% (100-p), L (allowable error) is 5%.

All known cases of type 2 diabetes who were hospitalized or attended outpatient department of general medicine and fit to the inclusion and exclusion criteria were included for the study till the calculated sample size achieved. Patients age more than 18 years and willing to give informed written consent to participate in the study were included. Patients with type 1 Diabetes, liver, kidney, heart disease, malignancy, pregnant and lactating women and other endocrine disease were excluded from the study. Patients on drugs like odides, beta blockers, carbimazole, propylthiouracil, lithium, interferon alpha, potassium iodide, and Lugol's iodine were also excluded from the study.

After getting informed written consent venous blood was collected from the study participants and Thyroid profile and HBA1C test was done. Thyroid dysfunction was classified as clinical hypothyroidism if TSH > 4.20 µUI/mL and FT4 < 0.93 ng/dL; Subclinical hypothyroidism if TSH > 4.20 µUI/ml and FT4 ranged from 0.93 to 1.7 ng/dL; Subclinical hyperthyroidism if TSH < 0.27 µUI/ml and FT4 in the normal range (0.93 and 1.7 ng/dL) and Clinical hyperthyroidism if TSH < 0.27 µUI/ml and FT4 > 1.7 µUI/mL.[7] Person having a BMI 30 kg/m^2 or more than that were classified as being obese. [11]

All statistical analysis was carried out by SPSS V.25 for mac. The mean value was expressed as mean ± SD in continuous data and comparison of two variables were done using t test. To find out association between two variable using chi-square. 95% confidence interval with p value less than 0.05 was considered for the statistically significance. Receiver operative characteristic curve was plotted to predict thyroid dysfunction based on cut off value of TSH and HBA1C among type 2 diabetes patients.

RESULTS

Current study included total 193 patients with type 2 diabetes. Among them 28 (14.5%) were known cases of thyroid dysfunction and 19(9.8%) were newly diagnosed with thyroid dysfunction. So, overall prevalence of thyroid dysfunction among type 2 diabetic patient in study was 24.4%. Out of 193, 47 patients had thyroid dysfunction, majority 22(11.4%) had subclinical hypothyroidism. 13 (6.7%) had Hypothyroidism, 6 (3.1%) had subclinical Hyperthyroidism and 3(1.5%) had Hyperthyroidism. 3(1.5%) patients were euthyroid but they had history of thyroidectomy for large goitre so we had classified them in thyroid dysfunction group.

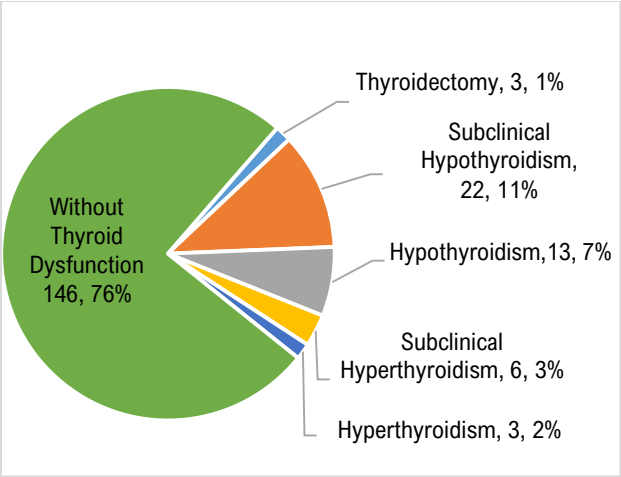

Figure 1 Distribution of study participants according to thyroid disease status

Overall patients with thyroid disfunction had slightly higher age (59.07 ± 11.18 years) compared to patients without thyroid dysfunction (58.14 ± 10.58 years). However, the difference in age between two group was statistically significant.

The prevalence of established thyroid disease was higher in females comprised of 32 (68.1%) patients than in males with 15 (31.9%) patients (p<0.05). Out of 193 diabetic patients, 133(68.9%) were had poor glycaemic control as their HBA1C was more than recommended level of 6.5%.[12] Diabetic patients who did not control their 3-month average blood sugar value had higher association with developing thyroid disfunction as 39(83%) patients with HBA1C more than 6.5 had thyroid dysfunction compared to patients with batter glucose control and the association was statistically significant.

There was total 129 (66.8%) were obese with BMI more than 30 kg/m^2 among them 31(24%) had thyroid dysfunction. Whereas out of 64 patients with less than 30 kg/m^2, 16 (25%) had thyroid dysfunction. There was no significant difference in BMI status of diabetic patients for thyroid dysfunction present or absent.

Diabetic patients with thyroid dysfunction had higher prevalence of tobacco use and prolonged duration of disease compared to patients without thyroid dysfunction However, the difference was statistically insignificant.

Table1 Association of different variables for thyroid dysfunction among type 2 diabetic patient

Variables	With thyroid dysfunction (n = 47)	Without Thyroid dysfunction (n = 146)	P value
Age (years)$	59.07±11.1	58.14 ±10.58	0.61
Females#	32 (68.1%)	63 (43.2%)	0.002*
Obesity (BMI 30 kg/m2) #	31 (66.0%)	98 (67.1%)	0.88
Tobacco user#	35 (74.5%)	94 (64.4%)	0.2
Duration of disease (years) $	2.89 ± 7.98	2.65 ± 8.77	0.86
HBA1C >=6.5%#	39 (83%)	94 (64.4%)	0.01*

#: Chi square applied, $: t test applied, *: statistically significant

Table 2 Predictors of Thyroid Dysfunction in T2DM Patients Using Binary Logistic Regression Test

Variables	Odds Ratio (95% CI)
Age (50 years Old)	2.0 (1.0-4.0) *
Female gender	2.8 (1.4-5.6) *
Obesity (BMI 30kg.m2)	0.9 (0.5-1.9)
Tobacco user	1.6 (0.7-3.3)
HBA1C >=6.5%	2.7 (1.2-6.2) *

*: statistically significant

Out of 92 patients above 50 years, 28(30.4%) had thyroid dysfunction compared to 19 (18.8%) out of 101 patients below 20 years of age. Diabetic patients age more than 50 years had 2-time higher chance to develop thyroid dysfunction compared to younger patients with age below 50 years. Similarly female diabetic patients had 2.8-time odds to have thyroid dysfunction compared to male diabetic patients. Obesity and Tobacco had not found statistically significant as a risk factor for developing thyroid dysfunction among diabetic patients. However, Diabetic patients had 2.7-time odds of having thyroid dysfunction if their glycaemic control is poor compared to batter glycaemic control.

The threshold value of HBA1C is 6.7% with 90% sensitivity and 73% specificity for developing thyroid dysfunction among type 2 diabetic patients [AUC: 0.874 (0.813-0.936)]. (Fig 2)

The threshold value of TSH is 3.65 mIU/L with 85.7% sensitivity and 65.2% specificity for developing thyroid dysfunction among type 2 diabetic patients [AUC: 0.807 (0. 740 -0.873)]. (Fig 3)

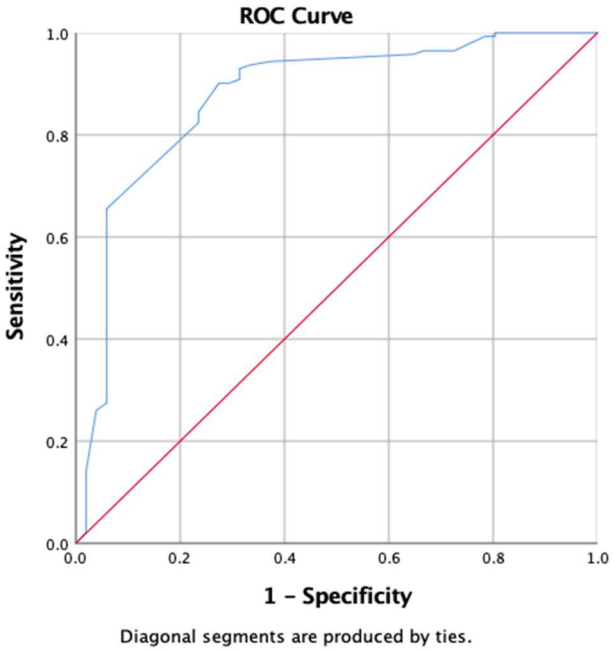

Figure 2 Identification of threshold value of HBA1C value for thyroid dysfunction among Type 2 diabetes patients.

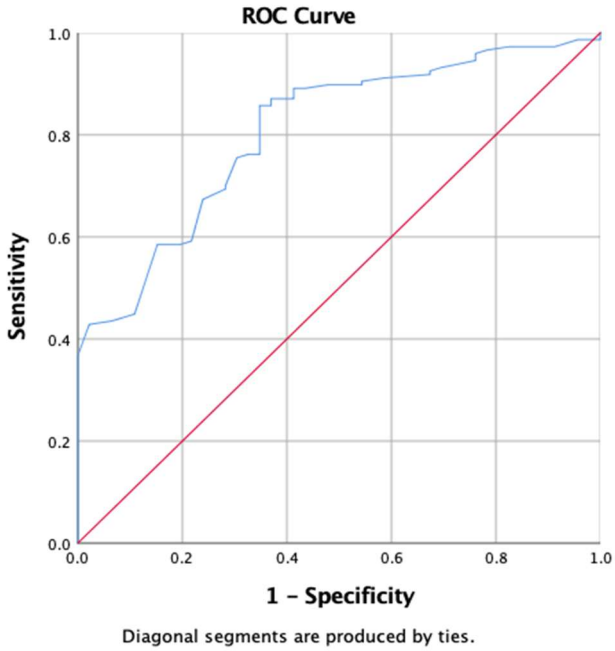

Figure 2 Identification of threshold value of TSH value for thyroid dysfunction among Type 2 diabetes patients.

DISCUSSION

The prevalence of TD in the general population varies greatly, from 6.6 % to 13.4 %.[7],[13],[14] Thyroid dysfunction has been documented to be associated with type 2 diabetic patients in many studies.[15] The prevalence of thyroid dysfunction is still higher in diabetic patients and ranges from 10 to 24%.[14],[16] Some studies have shown a reciprocal relationship between thyroid dysfunction and diabetes.[17] Our study found significant association of female gender, higher age and poor glycaemic control with thyroid dysfunction among type 2 diabetic patients.

In present study overall thyroid dysfunction was found among 47(24.3%) diabetic patients. Hypothyroidism (Clinical and subclinical: 35,18.13%) found more common compared to other thyroid disease. Subclinical hypothyroidism was the most frequent dysfunction found corresponding to 22, 11.39% of the diabetic patients which was comparable to study finding of Palma et al where 11,8% had subclinical thyroid dysfunction.[7] Similar to our finding prevalence of thyroid dysfunction was observed in 28% type 2 diabetic patients with subclinical hypothyroidism 18.8% as the commonest thyroid disorder in a study done by Ozair M. et al. [8]

In present study patient's thyroid dysfunction among diabetic patients with age more than 50 years had 2.0 (1.0-4.0) times odds compared to younger age patients. Age-related increases in thyroid dysfunction risk have been demonstrated by prior research.[18] However mean age difference between two group was found statistically insignificant.

According to Stanley et al[19]. study, HbA1c ≥7% (OR = 4.3, p = 0.025) and duration of DM >5years (OR = 3.3, p = 0.012) were significantly associated with thyroid dysfunction in type 2 diabetic patients. In present study we did not found any association between duration of disease however, we found cut off value of HBA1C of more than 6.7% with 90% sensitivity and 73% specificity for developing thyroid impairment [AUC: 0.874 (0.813-0.936)].

Based on Receiver operating characteristic curve, The threshold value of TSH was 3.65 mIU/L with 85.7% sensitivity and 65.2% specificity for developing thyroid dysfunction among type 2 diabetic patients [AUC: 0.807 (0. 740 -0.873)]. Similar to our finding a study done by Mang H. et al support that the best cut-off value of the TSH was 4 mIU/L (sensitivity 72.7%, specificity 94.6%, AUC = 0.832) for predicting thyroid dysfunction as Hashimoto thyroiditis among type 2 diabetes patients. [20]

Some limitation of the study should be noted that present study is cross sectional and we used a convenience sample of diabetic patients already treated in our hospital. Some type of selection bias

may occur as these patients are already under treatment so community-based waste study with bigger sample size is recommended.

CONCLUSION

Age more than 50 years and female gender played as risk factor for developing thyroid dysfunction among patients with type 2 diabetes. HBA1C more than 6.5% and TSH more than 3.65 mIU/L was independent risk factor for predicting thyroid dysfunction among type 2 diabetic patients.

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