

A STUDY OF THYROID DYSFUNCTION AND DYSLIPIDEMIA IN PATIENTS WITH TYPE-II DIABETES MELLITUS

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Abstract

Background: Thyroid disease and diabetes are the two most common endocrine disorders encountered in clinical practice and it is fairly common to encounter thyroid dysfunction in diabetic population. Diabetes Mellitus also appears to influence thyroid function, primarily at the level of hypothalamus and at the level of peripheral tissue, by converting T4 to T3. The present study aims to highlight the association between thyroid disorder and diabetes mellitus and outline strategies for thyroid screening and surveillance in patients with diabetes. **Materials and Methods:** A cross-sectional study comprising of 120 subjects with 60 diabetics aged more than 30 years irrespective of glycemic control, end organ involvement and treatment were included as study subjects whereas 60 apparently healthy non-diabetics were designated as controls. After informed consent, detailed history and thorough clinical examination was carried out. Blood samples for fasting plasma glucose and post prandial glucose were collected in sodium fluoride vacutainers. Samples were also collected for HbA1c, Thyroid profile and lipid profile. **Result:** Diabetes Mellitus and thyroid dysfunction both have a significant role in alteration of lipoprotein levels. **Conclusion:** Routine thyroid screening in type II Diabetes Mellitus patients helps in early detection and proper treatment of thyroid disorders which will improve the quality of life and reduce the morbidity rate in diabetics.

INTRODUCTION

The epidemic of Diabetes Mellitus and its complications has affected the whole world at an alarming rate, and more so in regions of economic transitions such as India.^[1-3] Diabetes Mellitus (DM) is considered one of the fastest growing health emergencies of the 21st century.^[4,5] The diabetes federation estimated that 537.0 million adults aged 20-79 years have diabetes mellitus in 2021.^[6,7] It is projected that 783.0 million people will be affected by diabetes by the year 2045 (IDF Diabetes Atlas, 2021). Between 2010 & 2030, it is predicted that there will be 20% and 69% rise in adults living with diabetes in developed and developing countries respectively.^[8-10] Asia has emerged as the epicenter of diabetes with India and China holding the baton.

The recent trend shows that the prevalence of diabetes has been escalating swiftly in middle and low-income countries.^[11] It is estimated that currently in India there are around 77.0 million patients suffering from diabetes.^[12] Thyroid disease and diabetes are the two most common endocrine disorders encountered in clinical practice and the relationship between them is characterized by a complex interaction of interdependence.^[13,14] An estimated 42 million people are suffering from thyroid disorders in India. It is not uncommon to frequently encounter thyroid dysfunction in diabetic population.^[15-17] Researchers have exhaustively studied the association of thyroid dysfunction and diabetes mellitus for decades. However, for a long-time, focus of the association was with type I diabetes mellitus since the autoimmune mechanism

in type-1 diabetes correlates with thyroid autoimmunity.^[18-20] There are complex mechanisms of interplay and interdependence, which associates thyroid dysfunction with diabetes and vice versa. Hence, excess or deficit of one, results in functional derangement of the other.^[21,22] Diabetes Mellitus appears to influence thyroid function, primarily at the level of hypothalamic control of TSH release and also at the level of peripheral tissue, by converting T4 to T3. Hyperglycaemia is also known to cause a reduction in the hepatic concentration of T4-5' deiodinase, low serum concentration of T3, raised levels of reverse T3 and low, normal, or high level of T4. Thus, diabetes may disturb the regulatory actions of thyroid hormones. In euthyroid nondiabetic adults, the relationship between serum TSH and cholesterol appears to be modified by insulin resistance, such that those with higher serum TSH and relative insulin resistance are at greatest risk of dyslipidaemia.^[23-26] Diabetes mellitus is a disorder of severe insulin resistance that leads to increased risk of dyslipidaemia, which can be further complicated by thyroid disorders. In our study we aim to see the association between thyroid dysfunction and diabetes mellitus, highlight the importance of outlining strategies for thyroid disease screening and surveillance in patients with diabetes.^[27-30]

Aims and Objectives

- (i) To study the thyroid function through estimation of thyroid hormones and TSH and know the spectrum of thyroid dysfunction in patients with Type II Diabetes Mellitus.
- (ii) To assess dyslipidemia in patients with thyroid dysfunction (hyperthyroid & hypothyroid) and euthyroid patients of Type II Diabetes Mellitus.
- (iii) To compare and correlate thyroid parameters and dyslipidemia in patients of Type II Diabetes Mellitus with apparently healthy non-diabetics and find out its significance.

MATERIALS AND METHODS

A cross sectional study with 60 cases and 60 controls was conducted in BRD Medical College,

Gorakhpur (U.P.) India. All consenting patients with Type II Diabetes Mellitus of age >30 years, irrespective of glucose control, end organ involvement and treatment were included as study subjects whereas 60 nondiabetic apparently healthy individuals were included as controls. Those cases with known thyroid disorders, hyperlipidemia, other physical illness and physiological stress which induce alteration on the thyroid hormone were excluded from the study. After informed consent, detailed history of each participant regarding age, sex, address, religion, occupation, educational status, marital status and personal history was taken followed by thorough clinical examination carried out on every subject according to a pre-designed proforma. Additionally, anthropometric measurements including weight, height, Body Mass Index (BMI) and blood pressure were recorded. Family history of diabetes or thyroid disease with or without goiter was reported. The presence of any associated disease like hypertension, dyslipidemia, and thyroid disease was also documented. All the patients were instructed for at least 12 hours overnight fasting. Blood samples were withdrawn from the selected subjects in appropriate vacutainers. Blood sample for fasting plasma glucose and post prandial plasma glucose were withdrawn in sodium fluoride vacutainer. Samples for HbA1c were collected in EDTA vials. And serum separator tubes were used for estimation of thyroid profile and lipid profile. Laboratory data were collected including HbA1c, fasting blood sugar (FBG), 2-hour postprandial glucose (2hpp), in addition to lipid profile including total cholesterol, triglyceride, high-density lipoprotein (HDL), and low-density lipoprotein (LDL), Thyroid function tests, namely, Thyroidstimulating hormone (TSH), free thyroxine (FT4), and free thyroxine (FT3).

RESULTS

In our study, 14 (23.33%) out of 60 study subjects had thyroid dysfunction while rest 46 were euthyroid whereas amongst 60 controls only 9 (15%) were having thyroid disorders.

[Table 1] illustrates that out of 14 cases with thyroid dysfunction, 16.7 % cases had sub-clinical hypothyroidism followed by hypothyroidism (5.0%) and then hyperthyroidism (1.6%) while among non-diabetic subjects, 11.7 % were having subclinical hypothyroidism and only 3.3 % were having hypothyroidism.

Table 1: Illustrates that out of 14 cases with thyroid dysfunction

	Number of cases	%	Number of controls	%
Hypothyroidism	03	5 %	2	3.3 %
Hyperthyroidism	01	1.6 %	0	-
Sub clinical hypothyroidism	10	16.7 %	7	11.7 %
Subclinical hyperthyroidism	0	0	0	-
Total	14	23.3 %	9	15 %

[Table 2] illustrate that out of 60 cases, 38 (63.3%) cases showed deranged lipid levels while only 41.7 % non-diabetic controls showed dyslipidemia. Out of this, 9 (15%) males and 29 (48.3%) females had dyslipidemia.

Table 2: Dyslipidemia in Cases and Dyslipidemia in Controls

	Dyslipidemia in Cases	%	Dyslipidemia in Controls	%
Male	9	15 %	7	11.7%
Female	29	48.3 %	18	30%
Total	38	63.3 %	25	41.7%

[Table 3] illustrates that dyslipidemia was present in 14(23.3%) cases with thyroid dysfunction. Out of which 10 (16.7%) cases of sub-clinical hypothyroidism, 5% cases of clinical hypothyroidism and 100% cases of hyperthyroidism showed dyslipidemia.

Table 3: No of cases with dyslipidemia

No of cases with dyslipidemia	Hyperthyroidism		Clinical Hypothyroidism		Sub-clinical Hypothyroidism	
	Cases	Control	Cases	Control	Cases	Control
	1	0	3	2	10	7
	1.67%	-	5%	3.33%	16.7%	11.7%

It was also observed that 8 (18.18%) males and 12 (20.33%) females had hypothyroidism (clinical + subclinical).

HbA1c > 7% was seen in 11 (45.83%) cases of diabetics with hypothyroidism and 36 (45.56%) of euthyroid diabetics. Dyslipidemia was present in 15 (62.5%) hypothyroid diabetics. Complications were present in 10 (41.66%) cases with hypothyroidism. The correlation of thyroid disorder was not found to be statistically significant ($p < 0.05$) among males or females; also, no statistical significance was found between uncontrolled diabetes, dyslipidemia and complicated diabetes with thyroid disorder [Table 4].

Table 4: Observation on male and female

Variables	Hypothyroidism	Euthyroid	Significance (<0.05)
Male	5	3	0.35
Female	8	6	0.49
HbA1c >7 %	13	47	0.45
HbA1c <7%	9	51	0.48
Dyslipidemia	13	25	0.48
Complications	18	16	0.05

DISCUSSION

The mean age of the study population was 51.6 ± 10.2 years. Female to male ratio was 1.3:1 depicting female preponderance (57%) in study group while for control group it was 1.7:1. Majority of study group ($n=60$ cases) had diabetes for 6-10 years followed by equal proportion of cases in 05 years and more than 10 years of duration. Females had slightly higher duration of diabetes. The mean duration of diabetes was 7.67 ± 4.33 years. Mean HbA1c of our cases was $8.23 \pm 7.7\%$. Majority of females with increased duration of diabetes showed uncontrolled glycaemic status (HbA1c > 7%). Uncontrolled diabetes was present in 73.33% cases. Thyroid dysfunction was seen in 23.33% of the total 60 Type II Diabetes Mellitus patients while only 15% of the control group was having thyroid dysfunction. Most common thyroid dysfunction was sub-clinical hypothyroidism (16.7%), followed by hypothyroidism (5.0%) and hyperthyroidism seen in 1.6% of study group whereas among controls it was 11.7% (SCH), 3.3% had overt hypothyroidism while none had hyperthyroidism.^[31-38]

Thyroid dysfunction was more common in females. Mean value of TSH, T3 and T4 were 3.1 ± 2.5 μ IU/ml, 1.3 ± 0.8 ng/ml and 7.5 ± 2.2 μ dl, respectively. TSH was positively correlated with HbA1c but it was statistically not significant. Positive albeit insignificant correlation was seen

between TSH and lipid parameters (cholesterol, triglyceride, HDL) except LDL, where an insignificant and negative association was found.^[39-41] Dyslipidemia was seen in 63.3% of cases while 40% controls had dyslipidemia. Hypertriglyceridemia was the most common lipid derangement seen in both cases and controls. Dyslipidemia was seen in 63.3% diabetic cases with thyroid dysfunction while it was 41.7% among nondiabetics. Presence of dyslipidemia in patients with thyroid dysfunction was not statistically significant. Duration of diabetes and HbA1c were significantly increased in diabetics with thyroid dysfunction as compared to diabetic subjects with normal thyroid profile. No significant association was found between the hypothyroid and euthyroid diabetic subjects with respect to uncontrolled diabetes (HbA1c > 7%), dyslipidemia and complications related to diabetes.^[42-44]

CONCLUSION

Our study recorded a high prevalence of thyroid dysfunction in patients of type II Diabetes mellitus. Subclinical hypothyroidism was the most common thyroid dysfunction seen which was more commonly seen in females. Dyslipidemia and complications related to diabetes were also found to be more enhanced in diabetics with thyroid dysfunction as compared to non-diabetics. Thus, we

conclude that Diabetes Mellitus and thyroid dysfunction both have a significant role in alteration of lipoprotein levels and their collective presence have greater effect on control of diabetes and its complications. Thus, we recommend routine thyroid screening in type II Diabetes Mellitus patients, early detection and proper treatment of which will improve the quality of life and reduce the morbidity rate in them.

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