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A Prospective Study of Thyroid Dysfunction in Type-2 Diabetes Patients in a Rural Population

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ABSTRACT

Background: The thyroid gland is primarily in charge of regulating energy balance and metabolism. Thyroid hormone [TH] is thought to be an important anticipating factor for developing type 2 diabetes mellitus [T2DM] since insulin secretion and glucose metabolism are most strongly associated with the pathophysiology of T2DM. However, few studies in the general population with euthyroid status have looked at the association between TH, thyroid-stimulating hormone [TSH] and T2DM.

The Aim of The Work: The study aimed to assess thyroid function in type 2 diabetes mellitus and to know the spectrum of thyroid diseases in rural populations.

Patients and Methods: A cross-sectional study was carried out at St Peters Medical College Hospital and Research Centre, Hosur. The study selected type 2 diabetics attending outpatient department [OPD]/wards in the Department of General Medicine. Thyroid profile tests were performed on all participants in the trial to determine their thyroid status, as well as a target organ evaluation for diabetes, were also observed. FNAC, Thyroid Peroxidase Antibody [TPO-Ab], and thyroid ultrasound sonography test [USG] were done as required.

Results: Thyroid disorders were found in 40%, sub-clinical hypothyroidism in 25%, hypothyroidism in 10%, and hyperthyroidism in 5% of the cases. In the current study, 58 female patients and 42 male patients were present. Males [16.66%] had a lower incidence of thyroid disorders than females [56.89%]. Glycemic control was suboptimal in hyperthyroidism patients [55.5%]. The occurrence of thyroid diseases was unrelated to the duration of diabetes. Sub-clinical hypothyroidism was mostly observed in patients with severe diabetic microvascular complications.

Conclusion: The prevalence of thyroid disorders in T2DM was 40%. Females were more likely to have subclinical hypothyroidism. Glycemic control was poor in diabetics with hyperthyroidism. Patients with subclinical hypothyroidism had severe diabetic complications. Thyroid dysfunction was unaffected by the duration of diabetes.

Keywords: Type 2 Diabetes Mellitus; Poor Glycemic Control; Hyperthyroidism; Hypothyroidism; Sub-clinical Hypothyroidism.

INTRODUCTION

Diabetes mellitus is a metabolic syndrome characterized by impaired carbohydrate, lipid and protein and metabolism as a result of insufficient insulin secretion or decreased insulin sensitivity in the tissues [1].

Type 2 Diabetes Mellitus [T2DM] is a perilous health problem addressed globally, that affects both industrialized and developing countries [2]. DM and thyroid problems are both endocrine illnesses that are linked [3]. Thyroid diseases and diabetes mellitus have a complicated inter-dependence [4]. T2DM was correlated with a higher prevalence of retinopathy, nephropathy, cardio-vascular disease [CVD], and subclinical hypo-thyroidism [5]. Thyroid Stimulating Hormone [TSH] is a hormone released by the anterior pituitary gland that regulates the secretion of total thyroxine [TT4] and total triiodothyronine [TT3] [6]. As a result, diabetes patients should have their thyroid function checked. The American Diabetes Association [ADA] has long presumed that DM should be tested for thyroid disorders [7].

Because diabetes is the most prevalent endocrine metabolic disorder, more research into its relationship to another important endocrine gland function, the thyroid gland, was required [8]. However, the prevalence of thyroid dysfunction in diabetics differs greatly between studies; the link between these two disorders has long been acknowledged [9]. Long-term T2DM complications can considerably contribute to developing CVD and cancer, amid other diseases, along with the risk of death [10-12].

Diabetes mellitus is becoming more common around the world as an outcome of an aging population and lifestyle changes as a result of urbanization. According to statistics, 382 million people globally had DM in 2013, with 90 to 95 percent of them having type 2 diabetes [T2DM], and this figure by 2035 is expected to rise to 592 million [8.8 percent of adults aged 20 to 79 years] [10, 13].

According to the most recent national survey, China has emerged as the global epicenter of the T2DM epidemic, with diabetes mellitus afflicting more than 11.6 percent of the adult population [aged 18 and above] [14].

The thyroid gland is primarily in charge of regulating metabolism and energy balance [10, 15]. Thyroid dysfunction results in increased insulin resistance in adipose and muscle tissue [16] and also lowers glucose transport in myocytes [17]. In addition, recent research has shown that free triiodothyronine [FT3] regulates insulin secretion [18].

Thyroid hormone [TH] is thought to be an essential prognostic factor for developing T2DM as insulin secretion and glucose metabolism are most strongly associated with the T2DM pathogenesis. TSH binds to receptors on thyroid epithelial cells and stimulates TH production and secretion by inhibiting negative feedback [10, 19, 20]. However, few studies in the general population with euthyroid status have looked at the relationship between TH, TSH, and T2DM.

THE AIM OF THE WORK

To study thyroid function in diabetes mellitus and learn about the different types of thyroid dysfunction that can occur.

PATIENTS AND METHODS

This is a cross-sectional study at St Peters Medical College Hospital and Research Centre, Hosur. The study was done from August 2021 to January 2022, a period of six months. In this study, a total of 100 patients attending to OPD/Wards in the Department of General Medicine with T2DM who were diagnosed based on ADA criteria or who were on anti-diabetic therapy were included.

Inclusion Criteria: All patients with T2DM aged 18 years and over, from both genders were included in the study. All diabetes cases included in the study are irrespective of glucose control and treatment [oral hypoglycemic agents or insulin]. Patients with Type 1 diabetes [T1DM], gestational diabetes, fibro-calculous pancreatitis, pancreatitis, and steroid-induced diabetes were excluded from the study. All those who had proven thyroid disorders and were on treatment were also excluded from the study.

A detailed history was documented and an examination was performed as per the proforma. Along with hematological and standard urine tests, all patients underwent target organ examination for DM. Thyroid status was assessed in all patients, with T3, T4, and TSH levels measured as needed. Fine Needle Aspiration Cytology [FNAC] and biopsy were performed by our pathologist if required. The laboratory examination of thyroid function was done by the assessment of serum TSH, T3, and T4 levels by the chemiluminescence assay method. Two ml of blood was drawn and centrifuged, and 500 micro litres of serum were extracted and incubated for one hour at room temperature with the reagent [separate for T3, T4, and TSH]. The COBAS 6000 equipment was used to take the readings later. All participants were screened for DM complications like

neuropathy, nephropathy, and retinopathy. [21] The ADA diabetes criteria were used to diagnose the patients; an oral glucose tolerance test, symptoms of diabetes and a RBS concentration of 11.1 mmol/L [200 mg/dL] 'or' FBS of 7.0 mmol/L [126 mg/dL] 'or' PPBS of 11.1 mmol/L [200 mg/dL]. [22]

Statistical Analysis: Descriptive data regarding frequencies is reported as percentages and proportions. To identify significant differences and relationships among various factors, a Chi-square [χ^2] test for trends was used. A p-value of 0.05 or less was regarded statistically significant for all tests.

RESULTS

Thyroid function tests were used to screen 100 diabetes patients for thyroid disorders in this study [TFT]. Among 100 diabetes patients, 60 had no thyroid disorder. Twenty-five had sub-clinical hypothyroidism, 10 had hypothyroidism, and five had hyperthyroidism.

In our study, we enrolled 100 patients. 42 were male and 58 were female. Patients in the age group of 46–60 years old were majority [36 patients], followed by 31–45 years [32 patients], 18–30 years [22 patients] and > 60 years [10 patients]. Fifty-four [54] people had diabetes for 0–5 years, 36 for 6–10 years, and 10 had diabetes for more than 10 years. The chi-square value [p=0.0012] was highly significant. Thyroid dysfunction was found in 7 of 42 male patients and 33 of 58 female patients. Thyroid disorders were found to be prevalent in 16.66 percent of males and 58.69 percent of females in this study, with 40 percent of females having sub-clinical hypo-thyroidism and 5.17 percent having hyperthyroidism. Subclinical hypothyroidism, hypo-thyroidism, and hyperthyroidism were found in 7.14 percent of males, hypothyroidism in 4.76 percent, and hyperthyroidism in 4.76 percent. Two male and eight female patients had overt hypothyroidism with a significant p-value.

In our study, 43 patients had DM with microvascular complications, and 57 had no complications. Retinopathy was present in 12 of the 43 patients with complications, nephropathy in 18, and neuropathy in 14. Three of the 11 retinopathy patients had thyroid disorders, with two having sub-clinical hypothyroidism and one having hyper-thyroidism. Thyroid dysfunction was observed in four participants, three of whom had sub-clinical hypothyroidism and one of whom had hyper-thyroidism. Nephropathy was found in 18 patients, but thyroid impairment was found in only four. Fourteen patients with thyroid disorders had neuropathy, 2 of whom had sub-clinical hypo-thyroidism.

Table [1]: Gender wise distribution

	Male	Female	Total
Hypothyroidism	2	8	10
Sub-clinical hypothyroidism	3	22	25
Hyperthyroidism	2	3	5
Normal	35	25	60
Total	42	58	100

Table [2]: Age-wise distribution

Age group	Male	Female	Total
18-30	15	7	22
31-45	12	20	32
46-60	10	26	36
>60	5	5	10
Total	42	58	100

Table [3]: Prevalence of thyroid dysfunction in diabetes

Thyroid disorder	No of cases
Normal	60
Sub-clinical hypothyroidism	25
Hypothyroidism	10
Hyperthyroidism	5
Total	100

Table [4]: Thyroid dysfunction and the duration of diabetes

Duration DM	No of patients	Thyroid disorder	%
0-5 years	54	24	44.44
6-10 years	36	14	25.71
>10 years	10	2	20.0

Table [5]: Thyroid dysfunction with diabetes complications

	Total	Thyroid disorder	%
DM with microvascular complications	43	23	53.49
No complications	57	17	29.82

Table [6]: Thyroid dysfunction in patients with diabetes complications

DM Complications	No of patients	No of patients with thyroid disorders
Retinopathy	12	3
Nephropathy	18	4
Neuropathy	14	4

Table [7]: Mean and Standard Deviation [SD] for various biochemical values in diabetes and diabetes with thyroid disorders

Parameters	T2DM subjects	T2DM with thyroid disorders
TSH	2.13±1.14	8.9±4.84
T4	7.09±1.94	8.08±5.12
T3	1.24±0.69	1.56±1.27
FBS	160.43±71.49	130.69±40.14
PPBS	242.73±97.91	214.45±64.39

DISCUSSION

The thyroid function of 40% T2DM patients was found to be abnormal with 35% of hypothyroidism and 5% hyperthyroidism. In the current study, 42 patients with T2DM out of a total of 100 were male. In another study, Palit *et al*. observed that thyroid diseases were seen in 9.7% of T2DM patients [n=306] and during their follow-up, 5.2% developed sustained thyroid dysfunction with subclinical hypothyroidism [3.9%] being the most prevalent. [23] According to our findings, thyroid dysfunction is more often found in females than in males. The range of thyroid disorders was different by gender. Furthermore, in the current study, females [37.93%] have more sub-clinical hypothyroidism than males [7.14%]. Females [5.17 percent] had more hyper-thyroidism than males [4.76 percent], but there was no statistical difference. Thyroid hormones possess pleiotropic influence on body composition metrics in euthyroid T2DM patients, according to retrospective cross-sectional research by Chen *et al.*, and sex variations may impact the connection. Further-more, ale patient's muscle and fat distribution is more prone to be impacted by thyroid function than females', and greater T3 levels are linked to a better body composition [less fat and more muscle mass] in female T2DM patients [24]. Hypothyroidism was found in all age group of people with type 2 diabetes, whereas hyper-thyroidism was found in people aged 46 to 60. We divided the 100 DM patients in this study into three groups based on their diabetes duration. In this study, increased diabetes duration did not affect thyroid dysfunction [p = 0.0012].

In the light of clinical and laboratory evidence, 43 patients with T2DM had diabetes complications in the form of retinopathy, nephropathy, and neuro-pathy in this study. Thyroid problems were found in 23 of the 43 patients. In a cross-sectional study, Mehalingam, *et al*. observed no association between thyroid disease and T2DM complications [25].

Comparison of studies- prevalence of thyroid dysfunction in diabetes

Studies	Prevalence of Thyroid dysfunction in Type 2 DM	Hypothyroidism	Hyperthyroidism
Mehalingam V, *et al.* [25]	17.5%	13.9%	3.6%
Pasupathi *et al*. [26]	45%	28.00%	17.00%
C.E.J. Udiong[27]	46.50%	26.60%	19.90%
Vamshidhar [28]	16%	6%	2%
A. Papazafiropoulou [29] **[Greek study]**	12.30%	---	---
Ravisankar *et al*. [9]	29%	16%	13%
The present study	40%	35%	5%

Conclusion: The prevalence of thyroid disorders in diabetics was 40%. Females were more likely to have subclinical hypothyroidism. Glycemic control was poor in diabetics with hyperthyroidism. Patients with subclinical hypothyroidism had severe diabetic complications. Thyroid dysfunction was unaffected by the duration of diabetes. In the above study, we also emphasize the need for thyroid screening in all diagnosed cases of T2DM.

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None

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