Original Research Article

Assessment of thyroid profile in diabetes mellitus at Chengalpattu Medical College and Hospital

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Abstract

Introduction: Diabetes mellitus (DM), a common endocrine metabolic disorder, is an important cause of morbidity and mortality worldwide. Thyroid dysfunction has been frequently encountered in diabetic patients with hypothyroidism being the most common type of dysfunction. Diabetics have a higher prevalence of thyroid disorders when compared with general population.
The aim of the study: The aim of the present study was to find the prevalence of thyroid dysfunction in patients with type 2 diabetes mellitus (type 2 DM) attending an outpatients department and medical wards of Chengalpattu Medical College and Hospital.
Materials and methods: Total of 100 subjects were studied, divided into two groups A - 50 known type 2 diabetic patients and group B - controls group which consisted of 50 nondiabetic indiuvals. Fasting venous blood sample was taken and analyzed for blood glucose, serum T3 (Triiodothyronine), serum T4 (Thyroxine) and serum TSH (Thyroid stimulating hormone) were analyzed.
Results: The levels of serum TSH and fasting blood sugar were significantly increased while serum T3 and T4 levels were significantly decreased in Group –A when compared to Group- B.
Conclusion: This study showed high prevalence (40 %) of thyroid dysfunction in type 2 DM. Subclinical hypothyroidism is the most common in type 2 DM. So, routine Assay of thyroid hormones in type 2 DM is needed in those patients.

Key words

Diabetes Mellitus, Insulin Resistance, Thyroid Stimulating Hormone.

Introduction

The WHO estimated diabetes prevalence was 2.8% in2000 and 4.4% in 2030. The total no. of people with diabetes is projected to rise from 171 million in 2000 to366 million in 2030 [1]. The thyroid is also most common endocrine disorder in the general population after diabetes. After 1979 a number of studies estimated the prevalence of thyroid dysfunction among diabetes patients ranging from 2.2-17%. However, fewer studies have estimated the higher prevalence of thyrodiabetics i.e. 31% and46.5% respectively [2]. Defective insulin secretion leads to various metabolic aberrations in T2DM, spanning from hyperglycemia due to defective insulin-stimulated glucose uptake and up-regulated hepatic glucose production, along with dyslipidemia, which includes impaired homeostasis of fatty acids, triglycerides, and lipoproteins. DM appears to influence thyroid function in two sites; firstly at the level of hypothalamic control of TSH release and secondly at peripheral tissue by converting T4 to T3. Hyperglycemia causes a reduction in the hepatic concentration of T4-5 deiodinase, low serum concentration ofT3, raised levels of reverse T3 and low, normal, or high level of T4. Thyroid hormone regulates metabolism and diabetes can alter metabolism [3]. The thyroid gland responds by producing and releasing the 2 thyroid hormones: Tri-iodothyronine (T3) and Thyroxine (T4). Two primary pathological conditions involving the thyroid gland are hyperthyroidism and hypothyroidism. Hypothyroidism occurs when the thyroid gland is not producing enough of thyroid hormones and is by far the most common thyroid disorder in the adult population [4]. Hyperthyroidism is a condition in which thyroid gland is overactive and produces excessive amounts of thyroid hormones. As insulin and thyroid hormones are intimately involved in cellular metabolism, excess or deficit of either of them result in the functional derangement of the other [5]. The physiological and biochemical interrelationship between insulin and the influence of both insulin and iodothyronines on the metabolism of carbohydrates, proteins, and lipids have been recorded. Such records indicate that iodothyronines are insulin antagonists with high levels being diabetogenic while the absence of the hormone inhibits the diabetes development. Presence of thyroid dysfunction may adversely affect diabetes control [6]. Hyperthyroidism increases the rate of gastrointestinal glucose absorption and increases insulin resistance and insulin degradation and is typically associated with worsening glycemic control in diabetic subjects 22 while hypothyroidism increases susceptibility to hypoglycemia thus complicating diabetes management. Thyroid hormone abnormalities are frequently associated with diabetes and unidentified thyroid dysfunction could negatively impact diabetes and its complications [7].

Materials and methods

This study was conducted on 100 individuals in the age group of 40-70 years during the year 2016-2017. The study group consists of 25 individuals who were diagnosed as type 2 diabetics without any complications (newly diagnosed or known diabetics on treatment), Group –A 50 individuals with type 2 diabetes with diabetic nephropathy and Group –B 50 ages and sex-matched healthy individuals (control). Individuals with previous history of thyroid disease, co-existing hepatobiliary disease, pregnancy, on systemic drug therapy such as thyroxine, antithyroid drugs, glucocorticoids and oral contraceptives are not included in the study group to avoid its influence on various parameters analyzed in this study. After obtaining the informed consent, by the aseptic precautions, 7 ml of blood was collected from an anticubital vein after 8-12 hours of fasting. Blood was collected in EDTA vacutainer (2 ml) and plain vacutainer (5 ml). Blood collected in plain vacutainer was processed to obtain serum. Serum T3 Serum T4, Serum TSH was measured by chemiluminescence method in immulite 1000 autoanalyzer.

Guidelines for detection of thyroid dysfunction

- Normal – when T3, T4, and TSH were in normal range
- Primary Hypothyroidism – when TSH more than 5.5 mIU/ml and T3, T4 less than normal.
- Primary Hyperthyroidism – when TSH is less than 0.3 mIU/ml and T3, T4 more than normal.
- Subclinical Hypothyroidism – when TSH is more than 5.5 mIU/ml and T3, T4 is within normal range.
- Subclinical Hyperthyroidism – when TSH is less than 0.3 mIU/ml and T3, T4 is within normal range.

Statistical analysis

The results obtained and expressed in mean ± SD. The comparison was done by student t-test and each parameter was done by SPSS statistical package version 18.0. p-value < 0.05 was considered statistically significant.

Results

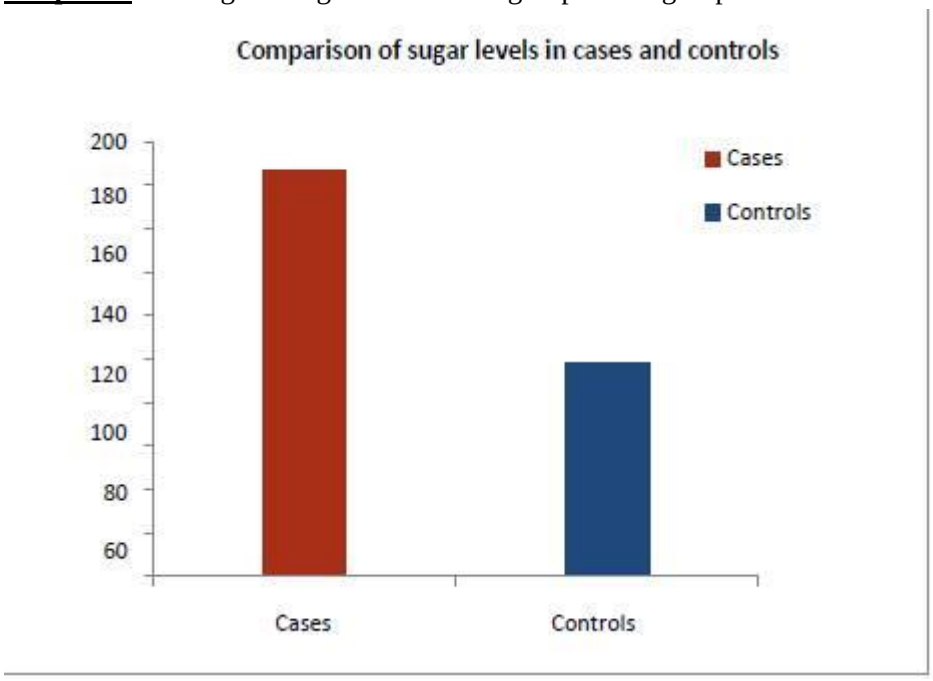
The sex and age distribution of diabetic and nondiabetic patients was as per **Table - 1**. Type 2 DM patients included 20 males and 30 females whereas nondiabetic patients included 35 males and 15 females with a mean age of 40.09 ± 5.06 and 47.37 ± 6.19 respectively.

Table - 1: Sex and age wise distribution of group- A and group- B patients.

Groups N= 100	Male	Female	Mean age in years
Group–A (n=50)	20	30	40.09 ± 5.06
Group–B (n=50)	35	15	47.37 ± 6.19

Graph - 1 shows the mean fasting blood glucose among subjects Group A 167.07 ± 50.57. In group b it was around 98.10 ± 14.55, which was found to be statistically significant of p-value < 0.0001*.

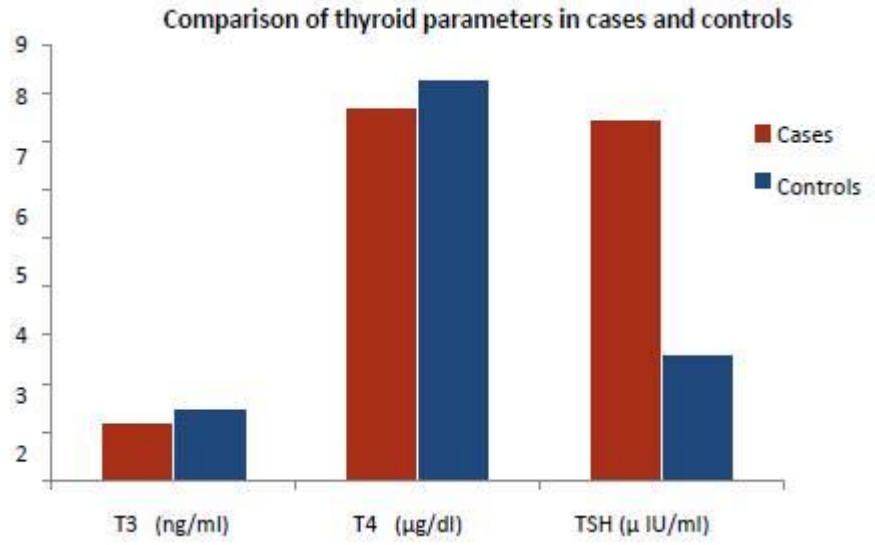
Graph – 1: Fasting blood glucose level in group A and group B.



Graph - 2 Shows the level of serum thyroid hormones in diabetic and nondiabetic patients. The serum levels of T3and T4 were significantly lower in diabetic compared to nondiabetic patients whereas the level of serum TSH was significantly higher in diabetic patients as compared to the nondiabetic patient. It showed thyroid disorder according to the gender in type 2

DM and nondiabetic control subjects. Out of 50 type 2 DM subjects, 40% showed abnormal thyroid functions (22% had hypothyroidism and 8% had hyperthyroidism) and 70% showed normal thyroid functions. The incidence of thyroid disorder was more in females as compared to males in type 2 DM.

Graph – 2: Thyroid function test among group A and group B.



Discussion

The study showed that the serum T3 and serum T4 levels were decreased, and serum TSH levels were increased in type 2 diabetics without any complications and type 2 diabetics with nephropathy when compared to controls. We have observed that there is no substantial change in the levels of serum T3, T4 and TSH among diabetics without complications and diabetics with nephropathy [8]. A study by Jusufovics S, et al. showed that patients with type 2 diabetes had abnormal thyroid hormone levels. The level of T3, T4, FT3, and FT4 were significantly lower while the levels of TSH were significantly higher in type 2 diabetics as compared to non-diabetics. Significantly higher levels of serum creatinine, glycated hemoglobin was observed in diabetics as compared to non-diabetics subjects who agree with the findings of our study [9]. A study by Mogensen CE, et al., showed that the levels of FT3 were significantly lower in type 2 diabetics when compared with the controls. FT4 and TSH did not show any statistically significant difference between type 2 diabetics and controls. The mean serum ratio of FT3/FT4 was significantly lower in type 2 diabetics than in the control group. Presence of hypothyroidism among diabetics when compared to controls has also been documented by Saha et al., In diabetes mellitus, there is the influence of endocrine and non-endocrine organs other than pancreas [10]. There are alterations in the hypothalamus-pituitary-thyroid axis. Hypothalamic and plasma TRH, pituitary and plasma TSH, as well as TSH secretion rates are reduced, and the TSH response to TRH is decreased. Despite normal peripheral TSH metabolism.T3 and T4 production and iodide uptake by the thyroid are diminished. There are important structural changes in the thyroid gland and pituitary that are accompanied by marked alterations in their secretary activities. T4 deiodination to T3 in peripheral tissues is decreased [11]. Iodothyronines are insulin antagonist with high levels being diabetogenic, while the absence of the hormone inhibits the development of diabetes. These situations may prevail in diabetics and would be aggravated in poorly controlled diabetics. Stress, which is associated with diabetes, may also cause changes in the hypothalamus anterior-pituitary axis in a diabetic.In the present study, 8.3% (9) of the

patients had report suggestive of subclinical hypothyroidism, 2.8%(3) of the patients had report suggestive of subclinical hyperthyroidism, and 1.9% (2) of the patients had overt hypothyroidism [12].

This study was similar to Sawant, A.M., et al. who in their study of 908 type 2 diabetic patients found that 10.3%of patients had hypothyroidism (overt and subclinical) and 1.7% of patients had hyperthyroidism (overt and subclinical) [13]. Shan S, et al. in his study of 120 diabetic patients, 17% of patients had hypothyroidism and 7.5% had hyperthyroidism [14].

Staub JJ, et al. in their study of 290 type 2 DM patients found that 91 patients (31.4%) had abnormal TSH concentrations out of which 48.3% had subclinical hypothyroidism, 24.2% had subclinical hyperthyroidism, 23.1% had overt hypothyroidism, and 4.4% had overt hyperthyroidism [15]. In the present study, diabetic patients when compared with the control group of normal patients in Whickham study and a 20 years follow-up of Whickham survey by Swamy RM, et al. show that the prevalence of altered thyroid profile in the study group is significant (P = 0.0064) [16]. The prevalence of thyroid disease as per Colorado thyroid disease prevalence conducted in 1995 was estimated to be 6.6% in the general population, with hypothyroidism being the most common presentation [17, 18].

Conclusion

The present study demonstrates that the serum T3 and T4 levels were decreased while serum TSH level was increased in type 2 diabetics when compared to controls. There is a higher prevalence of abnormal thyroid hormone levels in type 2 diabetics. Presence of abnormal thyroid hormone levels in diabetics, if unrecognized, may be a primary cause of poor management often encountered in some treated diabetics. Hence there is a need for the routine assay of thyroid hormones in diabetics which will help in the early detection and treatment of thyroid dysfunction. This helps improve the quality of life and reduce the morbidity rate in diabetic patients.

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