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IJPBS |Volume 5| Issue 1|JAN-MAR|2015|24-30

Research Article
Biological Sciences

STUDY OF THYROID PROFILE IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

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ABSTRACT

Background: *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. Alteration in thyroid function complicates the management of diabetes mellitus and its complications.* ***Methods:*** *Total of 60 subjects were studied, divided into two groups - cases group which consists of 30 known type 2 diabetic patients and controls group which consists of 30 normal healthy individuals. Fasting venous blood sample was taken and analyzed for blood sugar, serum T3 (Triiodothyronine), serum T4 (Thyroxine) and serum TSH (Thyroid stimulating hormone) in both cases and controls.* ***Results:*** *The levels of serum TSH and fasting blood sugar were significantly increased while serum T3 and T4 levels were significantly decreased in cases when compared to controls.* ***Conclusion:*** *The present study suggests that the abnormal thyroid hormone levels seen in type 2 diabetics are due to alteration in Hypothalamo-pituitary-thyroid axis, which in turn produces significant metabolic disturbances. Hence, routine screening for thyroid dysfunction should be carried out in diabetics, which helps in its early diagnosis and treatment there by improves their quality of life and reduces the morbidity rate.*

KEY WORDS

Diabetes Mellitus, Hypothyroidism, Hyperthyroidism

INTRODUCTION

Diabetes mellitus (DM), a leading cause of death worldwide, is one of the most challenging health problems in the 21st century.[1,2,3] It is a group of metabolic diseases 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.[4,5] The vast majority of diabetic cases fall into two broad etiopathogenetic categories. One category is Type 1 diabetes, the cause of which is an absolute deficiency of insulin secretion. Type 2 diabetes is a second and more common form of diabetes mellitus and usually results from a combination of defects in insulin action and secretion.[4,5] The World Health Organization (WHO) estimated diabetes prevalence was 2.8% in 2000 and 4.4% in 2030. The total number of people with diabetes is expected to increase from 171 million in 2000 to 366 million in 2030.[6,7] Factors such as adoption of a sedentary lifestyle, dietary modifications, ethnicity, hypertension and obesity are thought to be major contributions to this epidemic.[8,9]

Thyroid diseases and diabetes mellitus are the two most common endocrinopathies encountered in clinical practice. Diabetes and thyroid disorders have been shown to mutually influence each other and an association between these two conditions has been reported in literature.[10,11] The report showing the association between diabetes and thyroid dysfunction were first published in 1979.[12] Since then a number of studies have estimated the prevalence of thyroid dysfunction among diabetic patients which ranges from 2.2 to 17 % .[13,14] However, a much higher prevalence of thyroid dysfunction in diabetes has been estimated by fewer studies i.e. 31 % and 46.5% respectively.[15,16] Diabetic patients have a higher prevalence of thyroid disorders compared to the general population. [17]

Upon stimulation by thyroid stimulating hormone (TSH), the thyroid gland responds by producing and releasing the 2 thyroid hormones: Tri-iodothyronine (T3) and Thyroxine (T4).[18] Two primary pathological conditions involving the thyroid gland are hyperthyroidism and hypothyroidism.[19, 20] Hypothyroidism occurs when thyroid gland is not producing enough of thyroid hormones and is by far the most common thyroid disorder in the adult population. Hyperthyroidism is a condition in which thyroid gland is overactive and produces excessive amounts of thyroid hormones.[4]

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. 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 absence of the hormone inhibits the diabetes development.[21]

The presence of thyroid dysfunction may adversely affect diabetes control. 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.[11] Present study was done to evaluate the thyroid profile in type 2 diabetic patients.

MATERIALS AND METHODS

Study was done for a period of one year from January 2014 to December 2014 in Katuri Medical College & Hospital. Study includes a total of 60 subjects divided into 2 groups – 30 cases and 30 controls. Informed consent was taken from both cases and controls and the study was approved by the institutional ethical and research committee.

A detailed proforma was filled up for each patient which included age, sex, past history of coronary artery disease, cerebrovascular accident, history of hypertension. The age of onset and duration of diabetes were recorded. As also recorded was whether the patient was treated with oral hypoglycemic agents or insulin or whether the patient was on diet control alone.

Venous blood samples were collected from patients after an overnight (8 hr) fasting in sodium fluoride tubes and plain tubes from cases and controls. T3, T4 and TSH were estimated by using Chemilumine scence Immunoassay (CLIA) method and Fasting plasma glucose by GOD-POD method.

Inclusion criteria:

i) Cases: 30 Diagnosed type-2 diabetic patients of age 40 -60 yrs of both genders who are on treatment, with no known complications and no history of previous thyroid disease were included.
ii) Controls: 30 age and sex matched normal healthy individuals without any history of diabetes and without known systemic disorders were included.

Exclusion criteria: Individuals with previous history of thyroid disease and on drugs that affect thyroid function, pregnancy, patients with diabetic complications.

Criteria used in the study for diagnosis of type 2 DM (According to American Diabetic Association) are 1) FBS (Fasting Blood Sugar) ≥ 126 mg/dl (7.0 mmol/L) or 2) Symptoms of diabetes plus RBS (Random Blood Sugar) ≥ 200 mg/dl (11.1 mmol/L).

Statistical analysis: The results obtained and expressed in mean ± SD. The comparison was done by student t test and statistical analysis of each parameter was done by SPSS statistical package version 15.0. p value < 0.05 was considered statistically significant.

RESULTS

The present study was conducted on 60 subjects aged between 40-60 years. This Case control study has 30 diagnosed type 2 diabetic patients of both genders who were on treatment with no known complications and no history of previous thyroid disease.

Table 1: Sex and Age Wise Distribution of Cases and Controls

	MALES	FEMALES	MEAN AGES
CASES	18	12	42.97 ± 4.12
CONTROLS	13	17	43.16 ± 5.06

Table 2: Test Parameters in both Cases and Controls

PARAMETER	CASES	CONTROLS	P value
FBS (mg/dl)	187.07 ± 80.57	98.10 ± 16.55	< 0.0001*
T3 (ng/ml)	1.16 ± 0.94	1.45 ± 0.35	< 0.0001*
T4 (µg/dl)	7.63 ± 3.92	8.24 ± 2.06	0.0023*
TSH (µIU/ml)	7.41 ± 6.72	2.57 ± 1.82	0.0048*

*p-value <0.05 significant.

Figure-1: Bar Diagram Showing Comparison of Sugar Levels in Cases and Controls

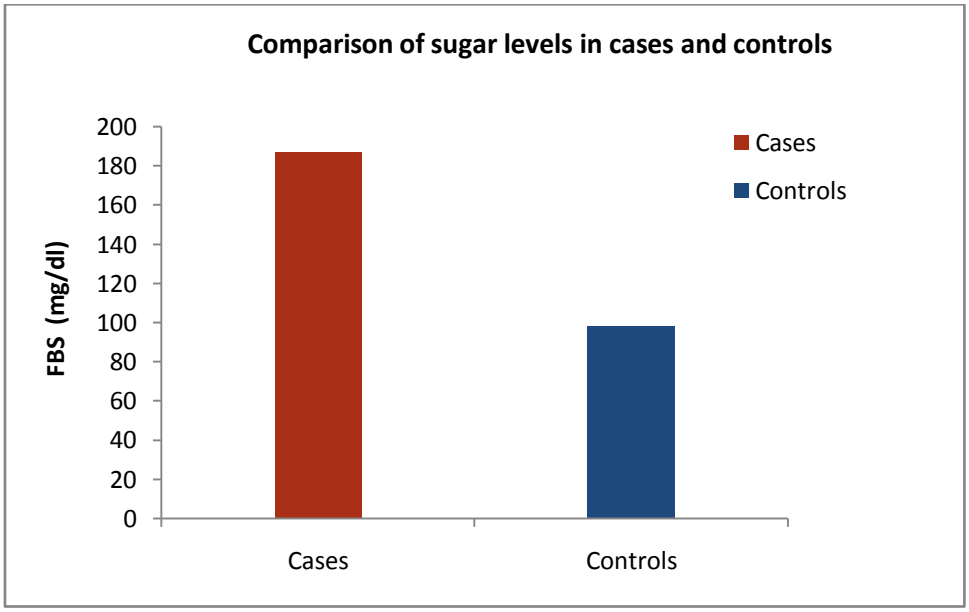
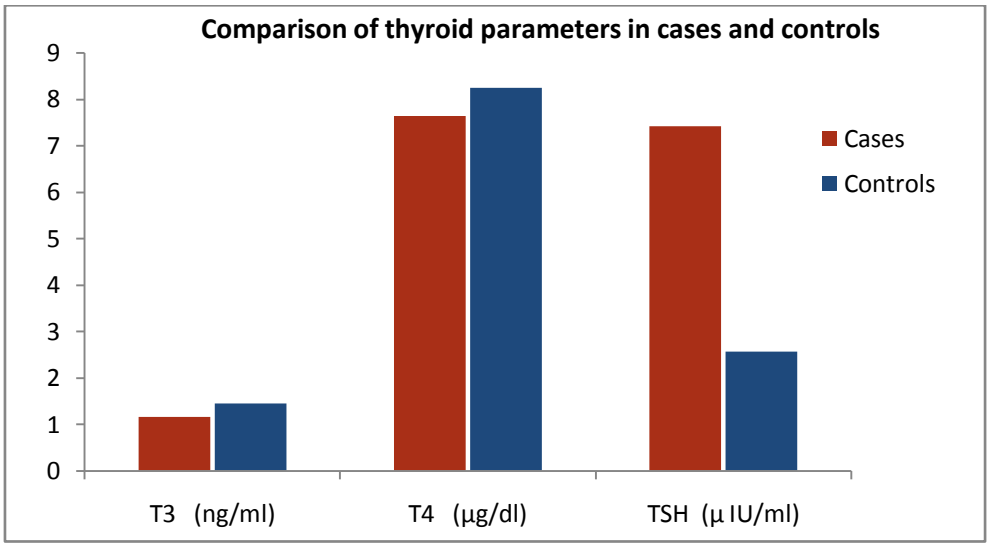


Figure-2: Bar Diagram Showing Comparison of Thyroid Parameters in Cases and Controls



The levels of serum TSH and fasting blood sugar were significantly increased while serum T3 and T4 levels were significantly decreased in cases when compared to controls.

DISCUSSION

Diabetes, a heterogenous endocrine metabolic disorder, is a leading cause of morbidity and mortality the world over. It has got worldwide distribution and its incidence is increasing day by day all over the world posing a major threat to the public health.[23] As a result of rapid urbanization and economic development, India will continue to have the largest number of diabetic subjects.[24] Diabetes is commonly associated with altered thyroid function. Thyroid disorders are also very common endocrine disorders in the general population after diabetes. Hence it is common for an individual to be affected by both thyroid diseases and

diabetes.[1] The aim of the study is to evaluate the levels of serum T3, T4 & TSH and fasting blood sugar in type 2 diabetic patients. The present study includes 60 subjects of which 30 were known type 2 diabetic patients (cases) and 30 were normal healthy controls. The results of the present study showed that the levels of serum T3, T4 were significantly lower in diabetics while serum TSH was significantly higher in diabetics when compared to that of controls. This is in accordance with the studies of Vikram BV et al,[6] Gurjeet S et al,[1] and Shekhar CY et al.[19]

The fasting blood sugar level was significantly elevated in cases when compared to controls. This is in accordance with the studies of Priti S et al,[25] Samatha P et al,[26] and Reeta T et al.[27] Out of 30 diabetic subjects investigated in the present study, 16.7% i.e. 5 had hypothyroidism and 10% i.e. 3 had hyperthyroidism. Thus, a total of 26.7% diabetic patients showed thyroid dysfunction. Also, 6.7% i.e. 2 out of 30 controls had hypothyroidism. These observations show a high incidence of abnormal thyroid hormone levels in diabetics which is in accordance with studies of Vibha U et al[10] and Pasupathi P et al.[28]

The influence of endocrine and non-endocrine organs other than pancreas on diabetes is documented. Occasionally, other endocrine disorders such as altered thyroid hormone levels are found in diabetes. The presence of both high and low thyroid hormone levels in diabetics in this study may be due to modified Thyroid releasing hormone (TRH) synthesis and release and may depend on the glycemic status of diabetics. Glycemic status is influenced by insulin, which is known to modulate the levels of TRH and TSH. [13,29]

In diabetes there are alterations in the hypothalamo-pituitary-thyroid axis. The major alterations include a reduction in the hypothalamic and plasma TRH, pituitary and plasma TSH and TSH secretion rate. Despite normal peripheral TSH metabolism, response of TSH to TRH is also decreased. Production of T3 and T4 and iodide uptake by thyroid gland are diminished. There are also important structural changes in both thyroid and pituitary glands which are accompanied by marked alterations in their secretory activities. In addition to these, deiodination of T4 to T3 is decreased. [28]

Suzuki et al attributed the abnormal thyroid hormone levels found in diabetes to the presence of thyroid hormone binding inhibitor (THBI), an inhibitor of the extra thyroidal conversion enzyme (5'-deiodinase) of T4 to T3, and dysfunction of the hypothalamo-pituitary thyroid axis. These situations may prevail in diabetes 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 these diabetics. [30]

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 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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