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A Study of Thyroid Hormone and HbA1c Levels in Type 2 Diabetes Mellitus Patients.

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ABSTRACT

Introduction: Diabetes mellitus (DM) is one of the important health problems affecting the major populations worldwide. Diabetes mellitus, endocrine disorder which involves multiple organ systems and leads to significant morbidity and mortality due to accompanying complications. Thyroid diseases and diabetes mellitus are common endocrine disorders. The present study is carried out for the assessment of thyroid dysfunction in type 2 diabetic patients by measurement of serum T3, serum T4 and serum TSH levels.

Materials & method: This study was conducted in Department of Biochemistry in association with Department of Medicine, Index Institute for Medical Sciences & Research Center, Indore. A total of 300 subjected were enrolled into the study. They were divided into 2 groups, 150 age and sex matched healthy subjects were taken as group I (controls) (HbA1c: 5.5 to 6.5 %) and 150 type 2 diabetes mellitus subjects were taken as group II (HbA1c: >7.5 %). Age of the study subjects was 30 to 70 years. Under aseptic conditions, 5 mL Fasting venous blood sample is collected from all subjects in vacutainers, Serum sample was used for the estimation of Fasting sugar (GOD-POD method) by using ERBA EM360 fully analyzer, thyroid profile by ELISA method, and EDTA sample is used for estimation of HbA1c by using Resin Binding Method. Data were expressed as mean ±SD. P value

Results: fasting blood sugar and HbA1c levels were significantly increased in T2DM (group II) subjects compared with controls (group I). T3 levels were significantly decreased and TSH levels were significantly increased in T2DM subjects compared to controls. HbA1c is positively correlated with TSH.

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Conclusion: In this present study, we have observed that the abnormal thyroid hormone levels among type 2 diabetics. Therefore, there is a need for the routine assay of thyroid hormones in type 2 diabetes mellitus in order to improve the quality of life and reduce the morbidity.

Keywords: Diabetes mellitus, Hypothyroidism, Glycated hemoglobin

INTRODUCTION

Diabetes mellitus (DM) is one of the important health problems affecting the major population worldwide [1]. Diabetes mellitus, endocrine disorder which involves multiple organ systems and leads to significant morbidity and mortality due to accompanying complications [2]. Diabetes mellitus is characterized by absolute or relative deficiency in insulin secretion or insulin action or both, associated with hyperglycemia, and disturbances in carbohydrate, lipid and protein metabolism. Thyroid diseases and diabetes mellitus are common endocrine disorders [3]. Diabetic patients have increased prevalence of thyroid disorder, with hypothyroid being the most common [4]. In diabetic patients, thyroid dysfunction varies from 2.2% -17%. Diabetic women are more commonly affected than men [5]. Hypothyroidism is a clinical syndrome occurs from a deficiency of thyroid hormones. It is very common thyroid problem in diabetic patients [6]. Thyroid hormones are insulin antagonists, both insulin and thyroid hormones are involved in cellular metabolism. Excess or deficit of any one can result in functional derangement of the other [7]. Sub–clinical hypothyroidism is an independent risk factor for development of diabetic nephropathy [8]. Serum TSH and tissue insulin sensitivity have important effects on serum lipid parameters in type 2 diabetic patients. At low insulin sensitivity, relatively minor changes in TSH levels are associated with marked changes in lipid risk factors and thus cardiovascular risk [9]. Unrecognized thyroid dysfunction may impair metabolic controls in patients with diabetes and in addition may amplify existing cardiovascular risk. Recognition and treatment of thyroid dysfunction in diabetic patients will benefit glycaemic control, attenuate cardiovascular risk, and improve general well being [10].

Methodology

This is a case-control study, conducted in Department of Biochemistry in association with Department of Medicine, Index Institute for Medical Sciences & Research Center, Indore. After obtaining permission from Institutional Ethical Committee and written informed consent from study participants, a total of 300 subjected were enrolled into the study. They were divided into 2 groups, 150 age and sex matched healthy subjects were taken as group I (controls) (HbA1c: 5.5 to 6.5 %) and 150 type 2 diabetes mellitus subjects were taken as group II (HbA1c: >7.5 %). Age of the study subjects was 30 to 70 years. Patients with a history of hypertension, renal impairment, autoimmune disorders, cerebrovascular diseases, acute respiratory failure, previous vascular events (angina, myocardial infarction and acute arterial occlusion) were excluded from the study. A detailed clinical and physical examination was done for all study participants. Under aseptic conditions, 5 mL venous blood sample is collected from all subjects in vacutainers. The blood samples were centrifuged at 2500 rpm for 10minutes to obtain serum. The separated serum sample was used for the estimation of fasting sugar (GOD-POD method) by using ERBA Em360 fully

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analyzer, thyroid profile (serum T3, T4 and TSH) by ELISA method, and EDTA sample is used for estimation of HbA1c by using Resin Binding Method.

Statistical Analysis:

Microsoft Excel was used in creating the database and producing graphs, while the data were analysed using the Statistical Package for the Social Sciences (SPSS) version 23.0 for Windows.

Mean and standard deviation (±SD) were used to describe quantitative data meeting normal distribution. Continuous two independent groups were compared by parametric independent Student's t test. Discrete (categorical) groups were compared by chi-square ($\chi 2$) test. Bivariate analysis (Karl's Pearson's correlation coefficient) was used to determine the correlation between blood sugar level, HbA1c, Thyroid Function Test. p values less than 0.05 ($p<0.05$) was considered as statistically significant.

RESULTS

Fasting blood sugar and HbA1c levels were significantly increased in T2DM (group II) subjects compared with controls (group I). T3 levels were significantly decreased and TSH levels were significantly increased in T2DM subjects compared to controls (Table 1). HbA1c is positively correlated with TSH (Table 2). T4 levels were not significant.

Table.No:1. Thyroid profile, FBS& HbA1c in studied patients

Parameter	Case 150	Control 150	P value
FBS	187.89±57.70	91.98±9.94	**<0.001**
HbA1C	9.08±2.12	4.91±00.21	**<0.001**
T3	1.06±0.69	1.24±0.76	**0.027**
T4	7.08±3.22	8.03±3.15	**0.010**
TSH	8.86±8.32	5.24±5.36	**<0.001**

Table. No:2. Correlation of Diabetes profile with thyroid profile

Thyroid function profile	**Pearson's Correlation Coefficient**	**Fasting blood sugar**	**HbA1c Level**
TSH	**r value**	0.181**	0.118*
	p value	**0.002**	**0.041**
T3	**r value**	-0.068	-0.079
	p value	0.242	0.174
T4	**r value**	-0.10*	-0.096
	p value	0.082	0.095
**. Correlation is significant at the 0.01 level (2-tailed).			
*. Correlation is significant at the 0.05 level (2-tailed).			

Above table represent the Pearson Correlation (Bivariate analysis) of thyroid profile with the diabetes profile and observed a significant association of thyroid profile TSH and T4 was significant associated with fasting blood sugar. Negative sign shows the universally proportional correlation.

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DISCUSSION

The present study is carried out for the assessment of thyroid dysfunction in type 2 diabetic patients. The thyroid hormones, total T3, total T4 are insulin antagonists. These hormones potentiate the insulin action indirectly TRH synthesis decreases in diabetes. These could be responsible for the occurrences of low thyroid hormone levels in some diabetics [11,12].

The study showed that the serum total T3 levels decreased and serum TSH levels were increased in type 2 diabetics when compared to controls. A study by Singh G et al., reported that type 2 diabetes mellitus patients 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, which agrees with the findings of this study [13]. A study by Swamy RM et al., showed that the serum T4 level was low and TSH was high in type 2 diabetics when compared with controls and this difference was statistically significant. T3 was also low in type 2 diabetics when compared with controls but this difference was not statistically significant [14]. which correlates with our findings. A study by Chubb SA et al., had shown that the prevalence of subclinical hypothyroidism among type 2 diabetics is 8.6% [15]. Udiong CEJ et al., in Nigeria showed TSH levels in diabetics were significantly lower than the non–diabetics. The levels of T4 in diabetics were higher than the non–diabetics, T3 levels did not differ significantly between diabetics and controls [16]. On contrary we found decrease in the levels of T3 and T4 and increase in serum TSH levels in diabetics when compared to controls. In diabetes mellitus there is influence of endocrine and non-endocrine organs other than pancreas. 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. Iodothyronines are insulin antagonist with high levels being diabetogenic, while 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 anteriorpituitary axis in diabetics [16, 17]. Our result of a positive correlation between HbA1c and TSH is consistent with the results by VelijaAsimi et al [18]. They examined the effects of treatment of subclinical hypothyroidism on metabolic control and hyperinsulinaemia and concluded that the correlation between TSH andHbA1c were positive and significant. Studies have reported that, there is increased prevalence of thyroid dysfunction in diabetes mellitus patients, it is necessary to identify the people with greater risk like patients over 50 or 55 years of age, especially in clinically suspected patients or lipid abnormalities. So it is necessary to suggest that a testing of thyroid profile will help to analyze the development of hypothyroidism in patients with type 2 diabetes mellitus [19].

CONCLUSION

In this present study, we have observed that the abnormal thyroid hormone levels among type 2 diabetics. Failure to early identification of abnormal thyroid function may be a primary cause of poor management of diabetes mellitus. Therefore, there is a need for the routine assay of thyroid hormones in type 2 diabetics in order to improve the quality of life and

reduce the morbidity. The study on a larger population will help to give further information about the relationship between the glycated haemoglobin and thyroid functions.

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