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RESEARCH ARTICLE

CORRELATION BETWEEN THYROID PROFILE AND BLOOD GLUCOSE LEVEL IN TYPE-II DIABETES MELLITUS

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ABSTRACT

Thyroid dysfunction is an endocrine disorder commonly associated with Type-II Diabetes mellitus though their correlation is yet to be clearly understood. This study was conducted to establish a correlation between blood glucose level and thyroid profile in type-II Diabetic Mellitus patients. The study involved two groups: Case group and Control group. 50 patients of type-II Diabetes Mellitus having high circulating levels of Thyroid stimulating hormone (TSH) were considered as Case group and 50 non diabetic, healthy individuals having normal thyroid level were taken as the Control group. The study was conducted at Gujarat Cancer Society Medical College, Hospital and Research Center, Ahmedabad. Serum Glucose and thyroid hormones- thyroxine and triiodothyronine (Total T4 and T3) and thyroid stimulating hormone (TSH) were measured. Determination of serum hormones concentration was carried out using highly sensitive RIA technique. The results indicated a strong interrelation between recognition and treatment of thyroid dysfunction and management of Type-II Diabetes mellitus patients as this condition affects glycemic control.

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INTRODUCTION

Both Hypothyroidism and Diabetes mellitus show clinical signs and symptoms such as fatigue, lethargy and weight gain. Hyperthyroidism is typically associated with worse glycogenic control and increased insulin requirement, little attention is paid to the diagnosis of thyroid diseases in diabetics as they are diagnosed in only about half of the patients. (Ghazali and Abbiyesuku, 2010) Thyroid hormones have profound effects in the regulation of glucose homeostasis. These include modifications of circulating insulin levels and counter regulatory hormones, intestinal absorption, hepatic production and peripheral tissues uptake of insulin as well as stimulation of gluconeogenesis and glycogenolysis. (Ghazali and Abbiyesuku, 2010) Hypothyroidism is by far the most common thyroid disorder in the adult population and is more common in older women. It is usually autoimmune in origin, presenting as either primary atrophic Hypothyroidism or Hashimotos thyroiditis. It is been found that prevalence of hypothyroidism is higher in diabetic patients. A number of reports have also indicated a higher than normal prevalence of thyroid disorders among type II Diabetes Mellitus patients (0.2%-6%) hypothyroidism being the most common disorder (Ghazali and Abbiyesuku, 2010). Either T3 or T4 or both may be elevated or reduced and have both direct and indirect effects on blood glucose homeostasis. Elevated levels of free circulating thyroid hormones (hyperthyroidism) produce hyperglycemia by causing polyphagia, enhancing glucose absorption from the gastro-intestinal tract, accelerating insulin degradation and stimulating glycogenolysis. Reduced levels of the hormones (hypothyroidism) may cause hypoglycemia. (Danese *et al*., 2000)

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MATERIALS AND MATHODS

The present study was carried out in the Central Clinical Laboratory of GCS Hospital, Ahmedabad. It was a case-control study. Diagnosed cases of Diabetes Mellitus undergoing consultation with physician and endocrinologist at the "Gujarat Cancer Society Medical College Hospital and Research Center, Ahmedabad" belonging to the age group 25-75 years were selected for the study. A total of 100 patients were randomly selected from the OPD as well as IPD of GCS Hospital. They had a mean age of 47.5 years. Detailed information was taken from each subject regarding symptoms, duration and treatment, family history of diabetes other diseases as well as complications. 50 apparently healthy non- diabetic individuals having normal TSH were chosen as controls. Their mean age was 42 years old. On the other hand, 50 diabetic patients having high TSH level were taken as cases. Their mean age

was 49.8 years. Twelve hours overnight fasting venous blood samples were collected in fluoride and heparinised vacutainersunder supervision of consultant physician and endocrinologist and samples were centrifuged for the estimation of Fasting Blood Sugar (FBS), T3, T4 and TSH for both the case and control groups. T3, T4 and TSH levels were measured using ready to use Radio-immunoassay kits. Glucose estimation was done in ERBA XL 640 automated analyser based on the principle of photoelectric colorimetry.

RESULTS

The present study analyzed the fasting blood sugar and thyroid profile (T3, T4 and TSH) in Type-II Diabetes mellitus and compared it with the control population. Case group comprised of 21 male(42%) and 29 female (58%) patients having the mean age of 53 years and 47.5 years respectively and control group comprised of 21 male (42%) and 29 female (58%) healthy individuals having the mean age of 47 years and 43.5 respectively. The mean standard deviation of age and sex of case and control group is statistically insignificant, shown in Table 1 & 2.

Table 1. Age distribution of subjects studied

Age in years	Controls		Cases	
	No.	%	No.	%
Up to 30 years	7	6.0	3	14.0
31-40 years	12	14.0	7	24.0
41-50 years	16	36.0	18	32.0
51-60 years	10	20.0	10	20.0
61-70 years	4	22.0	11	8.0
>70 years	1	2.0	1	2.0
Total	50	100.0	50	100.0
Mean ± SD	45.2±12.5		49.8±11.2	

Table 2. Gender distribution of subjects studied

Gender distribution	Cases		Controls	
	No.	%	No.	%
Male	21	42.0	21	42.0
Female	29	58.0	29	58.0
Total	50	100.0	50	100.0

By using "Mann-Whitney U Test", the statistical values were obtained. In the thyroid profile, T3 and TSH level are significantly reduced in case group compared to control group which is shown in table-3 with P value less than 0.0001 respectively and was having >0.5 level of significance. T4 values statistically increased in case group compared to control group (table 1) and P value is 0.224 which is non significant and having > 0.05 level of significance. The level of fasting blood sugar is significantly elevated in case group compared to control group (P value less than 0.0001 which is shown in Table 3.

Table 3. Comparison of levels of sugar and thyroid parameters between controls and cases

Parameters	Cases	Controls	P value
FBS (mg/dl)	177.41±58.92 (115 -352)	101.92±8.43 (82-112)	<0.0001
T3 (ng/dl)	1.23 ±0.44 (0.36-2.6)	4.36±1.29 (0.8-3.6)	<0.0001
T4 (µg/dl)	6.31±3.05 (0.82-17.7)	6.65±1.82 (2.2-12.2)	0.224
TSH (MIU/ml)	37.97±38.16 (5-100)	2.21±0.97 (0.47-4.0)	<0.0001

Results are represented in Mean ± Standard Deviation (Min-Max).

Interpretation was done according to p value

$p < 0.001$ = Highly significant
$p < 0.05$ =Significant
$p \geq 0.05$= Not significant

DISCUSSION

The thyroid hormones, T3 and T4 are insulin antagonists that also potentiate the action of insulin indirectly. TRH synthesis decreases in diabetes mellitus. These facts could be responsible for the occurrences of low thyroid hormone levels in some diabetics. The level of TSH in our study was clinically significant in diabetics. Result obtained from the present study has shown that in Type-II diabetes mellitus, hypothyroidism, which is a better index to monitor type 2 diabetes mellitus, is frequently observed. (Vahab Fatourechi, 2009 and Bhalla *et al*., 1995) Subclinical hypothyroidism is defined as an asymptomatic state characterized by normal free T3 and T4 levels and elevated serum concentrations of thyrotropin (>4µU/ml). Diabetic patients have a higher prevalence of thyroid disorders compared with the normal population (Yegin, ?; Panteghini *et al*., 1995; Nobre *et al*., 2002) In the present study the distribution of age and sex in the control group matches with the case group. The fasting blood sugar levels were elevated in the case group as compared to the control group. This correlates with results reported earlier (Udiong *et al*., 2007; Patricia, 2000 and Swamy *et al*., 2012).

A study conducted in 2002, related to the association of type-2 diabetes mellitus with thyroid dysfunction indicate that there is a higher occurrence of thyroid dysfunction among diabetics, when compared with the general population. 12.7% of diabetics were found to have thyroid dysfunction. (Swamy *et al*., 2012) In 2007, it had been shown that 46.5% of diabetics had abnormal thyroid hormone levels. Twenty six percent of the diabetics had low levels of thyroid hormones while 19.9% had raised levels. Out of 161 diabetic patients 26.6% were hypothyroid and 19.9 % were hyperthyroid patients. (Feely and Isles, 1979) It has also shown that 22.4% of the diagnosed type-2 diabetes mellitus had subclinical hypothyroidism. (Isles *et al*., 1979) Earlier studies in 1979 emphasized the importance of screening of diabetic patients to identify hypothyroidism. (Kadiyala *et al*., 2010; Yasmin, ?; Duntas *et al*., 2011) Now it has been found that thyroid disease and both type I and II diabetes mellitus are strongly associated and this has important clinical implications for treatment requirements.

Also, diabetes mellitus patients with hypothyroidism are at risk for complications like nephropathy. In our study, it was found that the incidence of thyroid disease was more which is in accordance with the studies of rest of the studies. These significant percentages emphasize that the diabetic patients require to be followed up with thyroid profile. In order to assess the trend, this study compared the mean values of thyroid profile between controls and diabetics. It was found that the diabetics showed the trend towards the hypothyroidism. The pathophysiology of thyroid dysfunction in diabetes is still unclear; however thyroid antibodies have been

suggested to be one of the causative factors. (Duntas *et al*., 2011) Yet to be published review reveals that the cause may be due to the complex interaction of common signaling pathways of insulin modulation and feedback mechanism of thyroid hormones. Failure to recognize the presence of these abnormal thyroid hormone levels in diabetics may be a primary cause of poor management often encountered in some treated diabetics. There is therefore need for routine assay of thyroid hormone on diabetics, particularly those whose conditions are difficult to manage.

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