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Prevalence of Thyroid Dysfunction in Diabetic Patients of Visakhapatnam District

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ABSTRACT

The present study was designed to investigate the prevalence of thyroid dysfunction in patients with both type 1 and type 2 diabetes mellitus who attending outpatients department (OPD) of King George Hospital (KGH), Visakhapatnam. The population of 50 healthy volunteers and 200 diabetic patients attended OPD of KGH during September 2015 to September 2016. The age, sex, BMI and stress rate were noted. All the subjects were investigated for fasting blood glucose (FBS), glycosylated hemoglobin (HbA1c), lipid profile (total cholesterol, triglycerides, HDL, LDL and VLDL) and thyroid hormones (triidothyronine (T3), thyroxin (T4) and thyroid stimulating hormone (TSH)) were estimated. The incidence of thyroid dysfunction was also noted. The significant elevation of FBS, HbA1c, serum cholesterol, serum triglyceride, LDL levels and VLDL, lowered levels of HDL was observed in diabetic patients as compared to health volunteers. The level of T3 and T4 were not significantly altered while the level of TSH was significantly higher in diabetics as compared to healthy volunteers. The incidence of sub clinical hypothyroidism (25.3) was found to be more in type 2 DM patients compared to other states of thyroid dysfunction. The prevalence of thyroid dysfunction among type 2 DM patients is very high (25.3 %) with subclinical hypothyroidism is being most common. Continuous monitoring of thyroid hormones is important to control the prevalence of thyroid dysfunction in patients with type 2 diabetes mellitus.

KEY WORDS: Fasting Blood Sugar, thyroid dysfunction, Diabetes mellitus.

1. INTRODUCTION

The co morbidities of diabetes and thyroid dysfunction were found to be more in clinical practice (Jain, 2013). The incidence hypothyroidism is most common in diabetic patients. The prevalence of thyroid dysfunction varied from 2.2%–17% in both types of diabetics. When compared with normal people the diabetic patients have a higher prevalence of thyroid dysfunction like hyperthyroidism and hypothyroidism due to the lack of immune system and are likely to develop other autoimmune disorders. The thyroid hormones Triiodothyronine (T3), thyroxine (T4) and thyroid-stimulating hormone (TSH) are altered during the thyroid dysfunction.

There is a close connection between thyroid status and metabolic control and helps to monitoring of thyroid function in patients with diabetes mellitus. The available guidelines are either not specific regarding routine monitoring of incidence of diabetes (ADS, 2009). As recommended by the American Thyroid Association (ATA) guidelines frequent testing of thyroid dysfunction is required for patients with type 2 DM. High-risk type 2 DM patients may require more frequent testing of thyroid hormones (Ladenson, 2000).

The co morbidities mainly due to the thyroid hormones are insulin antagonists, both insulin and thyroid hormones are involved in cellular metabolism. The excess and deficit of any one of the hormones can effects the function of the each other. Thyroid disease is a pathological state that adversely affects diabetic control and is commonly found in most forms of diabetes mellitus which is associated with advanced age in type 2 DM and autoimmune diseases in type 1 DM. Conversely diabetes appears to influence thyroid function in two sites; firstly at the level of hypothalamic control of TSH release and secondly at the conversion of T4 to T3 in the peripheral tissue. Marked hyperglycemia causes reversible reduction of the activity and hepatic concentration of T4-5-deiodinase, low serum concentration of T3, elevated levels of reverse T3 and low, normal, or high level of T4. The present study was designed to investigate the association of diabetes with different types of thyroid dysfunction in both type 1 DM and type 2 DM patients of outpatient department of King George Hospital, Visakhapatnam.

2. MATERIALS

The study was conducted in 250 populations, who visited general and diabetic department of King George Hospital (KGH), Visakhapatnam from April 2016 to December 2016. The study was approved by Ethics Committee of King George Hospital (KGH), Visakhapatnam. Inclusion criteria used in the study for diagnosis of type 2 DM (According to American Diabetic Association) are 1) FBS (Fasting Blood Sugar) - ≥ 110 mg/dl and 2) RBS (Random Blood Sugar) - ≥ 200 mg/dl. Exclusion criteria used in the study was the patients with previous history of thyroid dysfunction and any other diseases in the both type I DM and type 2 DM. Patients under the drug therapy which affects the thyroid function were also excluded from the study. Venous Blood sample were taken and assessed for FBS, HbA1c, lipid profile and thyroid function tests such T3, T4 and TSH.

Method: FBS was measured by GOD POD method, HbA1c and Lipid profile by kit method. T3 and T4 estimated by using Chemi Lumination Immuno Assay (CLIA) and TSH was estimated using Ultra-Sensitive CLIA method. Normal ranges for FBS is 70-110 mg/dl, for HbA1c is 4.0-6.0%; for Total cholesterol is 150-200 mg/dl, for Serum triglycerides is 40-160 mg/dl, for Serum HDL is 35-60 mg/dl, for Serum LDL is <130 mg/dl, for Serum VLDL is 5-35 mg/dl. Normal range of the serum levels were 4-9.3 pmol/L for T3; 9-20.0 pmol/L for T4 and 0.3-5.5 mIU/L for TSH. The statistical analysis was evaluated by using student's t test, one way ANOVA and at the p value $p<0.05$ was considered as significant.

3. RESULTS AND DISCUSSION

The prevalence of thyroid dysfunction is high in India. According to an estimate around forty two million people in India are suffering from thyroid dysfunctions. The prevalence of thyroid dysfunctions is encountered high in known diabetic patients (Feely, 1979). The association of autoimmune thyroid disease with type 1 diabetes mellitus has been well documented across populations, with it being most prevalent immunological disease in patients with type 1 diabetes (Chikuba, 1992). Diabetes mellitus appears to influence thyroid function in two sites, firstly at the level of hypothalamic control of TSH release and secondly at the conversion of T4 to T3 in the peripheral tissue. Marked hyperglycemia causes reversible reduction of the activity and hepatic concentration of T4-5-deiodinase, low serum concentration of T3, elevated levels of reverse T3 and low, normal, or high level of T4 (Shah, 2014).

The population size of the present study was 250 patients. The control group contains 20% (50) populations. Among the population 29.6% (74) were type 1DM and 50.4% (125) were type 2DM. The male patients are prone to diabetic compare with the female patients. In type 1 DM in was 15.16% (39) and in type 2 DM was found to 29.6 % (74) for 250 populations. Different age group ranges from 20 yrs to 80 yrs were included in the study. At age group of 50-60 yrs of male patients were found to be 29% (11.6) more among the total populations (table.1).

Table.1. Age groups in diabetic and control group

	Control (n=50)		**Type 1 diabetics (n=74)**		**Type 2 diabetics (n=126)**	
AGE	**male**	**female**	**male**	**female**	**male**	**female**
20-30	1(0.4)	2(0.8)	1(0.4)	2(0.8)	3(1.2)	2(0.8)
30-40	3(1.2)	2(0.8)	2(0.8)	3(1.2)	12(4.8)	6(2.4)
40-50	8(3.2)	10(4.0)	20(8.0)	13(5.2)	20(8.0)	22(8.8)
50-60	4(1.6)	16(6.4)	11(4.4)	10(4)	29(11.6)	16(6.4)
60-70	1(0.4)	2(0.8)	3(1.2)	5(4.2)	6(2.4)	3(1.2)
70-80	1(0.4)	0(0)	2(0.8)	2(0.8)	4(1.6)	3(1.2)
Total	**18(7.2)**	**32(12.8)**	**39(15.16)**	**35(14.0)**	**74(29.6)**	**52(20.8)**

The BMI, a major predictor of obesity, was higher in the study population, except that of hyperthyroid subjects. Their lower BMI may have been due to increased metabolism in hyperthyroidism. Decreased basal metabolic rates (BMR) in hypothyroid subjects may also have been responsible for the increased BMI (Hettihewa, 2007). The present study the BMI of 18 to 36 kgm^2 was considered. Among 126 patients the male type 2 DM patients with BMI ranges of 22-28 were found to be 30.9% (39). But in 74 type 1 DM patient's 29.7% (22) female shown to have high BMI ranges at 22-28 as shown in table.2.

Table.2. BMI ranges of diabetic and control group

BMI ($Kg\ m^2$)	**Control (n=50)**		**Type 1 diabetics (n=74)**		**Type 2 diabetics (n=126)**	
	Male (18)	Female (32)	Male (39)	Female (35)	Male (74)	Female (52)
18-22	12(24.0)	26(52)	13(17.56)	2(0.28)	21(58.7)	11(8.7)
22-28	5(10.0)	4(8.0)	20(27.0)	22(29.7)	39(30.9)	27(21.4)
28-34	1(2.0)	2(4.0)	4(5.4)	10(13.5)	11(8.7)	13(10.3)
34-36	0(1)	0(0)	2(0.28)	1(1.35)	3(2.3)	1(0.79)

Stress is a leading cause of development of diabetes due to the interference in metabolic function (Surwit RS., 1992). Stress scale ranges from 1-10 are considered in the present study. The type 2 DM patients were found to have 4 to 6 scale of stress levels at 38.88% (49) among 126 patients. The higher number of type 1 DM patients, 37.8% (28) among 74 patients were under the stress levels of 2 to 4 (table.3). The study indicates that stress levels are more affected to type 2 diabetic patients than that of type 1 DM patients (Francescato, 2014). It might be due to the oxidative phosphorylation, and thyroid hormones mediated increased metabolic activity of major organs. Thyroid hormone is a major contributor in the production of the oxygen free radical due to its pro oxidant activity and resulted to decreased antioxidant defense mechanism during hyperthyroidism when compared to the normal and hypothyroidism (Suchetha Kumari, 2011).

Table.3. Stress levels in both diabetic and control group

Stress	Control (n=50)	Type 1 diabetics (n=74)	Type 2 diabetics (n=126)
0-2	24(48.0)	11(14.8)	16(12.6)
2-4	16(32.0)	28(37.8)	32(25.39)
4-6	10(20.0)	24(32.4)	49(38.88)
6-8	0(0)	9(12.1)	22(17.46)
8-10	0(0)	2(2.7)	7(5.55)

The FBS and HbA1c were found to be increased in both type 1DM and type.2, DM significantly. The levels are more in type 1 DM compared to the type 2 DM patients. In our study, table.4, indicates type 2 DM patients shows significant higher serum levels of cholesterol, triglycerides, LDL, VLDL and lower level of HDL than type 1 DM as compared to control population similar to the previous studies Elder, 1990.

Table.4. Blood glucose and lipid profile of diabetic and control group

Investigations	Control (n=50)	Type 1 diabetics (n=74)	Type 2 diabetics (n=126)
FBG (mg/dL)	92±12.06	231±21.09*	185±18.06*
HbA1c (%)	4.89±1.12	9.31±2.41*	8.62±3.91*
Triglycerides (mg/dL)	126.64±9.94	133.62±11.31^{ns}	157.41±9.17*
Total Cholesterol (mg/dL)	169.62±13.95	179.62±18.94^{ns}	212.38±12.98*
HDL (mg/dL)	36.21±3.06	34.64±2.16^{ns}	30.12±1.32*
LDL (mg/dL)	94.94±11.23	107.04±14.62^{ns}	123.94±16.99*
VLDL (mg/dL)	25.94±5.74	28.61±6.99^{ns}	39.13±4.97*

Values represented as Mean±SD; $^{ns}p>0.05$, $*p< 0.05$ significance followed by one-way ANOVA followed by Dunnet's test as compared with control.

The t3, t4 and TSH levels were evaluated in all the study populations. There was no significant change of t3 and t4 in type 1 DM and type 2 DM patients and significant change was observed in TSH levels in both type 1 DM and type 2 DM patients (table.5). The significance was more in type 2 DM patients compared with type 1 DM patients.

Table.5. Hormone levels in patients of diabetic and control group

Investigations	Control (n=50)	Type 1 diabetics (n=74)	Type 2 diabetics (n=126)
T3 (pmol/L)	4.27±0.94	4.82±0.71^{ns}	5.06±1.29^{ns}
T4 (pmol/L)	7.29±0.98	6.98±1.94^{ns}	7.95±2.15^{ns}
TSH (mIU/L)	1.24±1.95	5.94±3.94*	8.94±4.98*

Values represented as Mean±SD; $^{ns}p>0.05$, $*p< 0.05$ significance followed by one-way ANOVA followed by Dunnet's test as compared with control.

Thyroid dysfunctions are classifies into five categories. The clinical and subclinical hypothyroidisms are found be more in diabetics due the resistance to the insulin (George, 2006). The low levels of insulin secretion due to the lack of glucose utilization in peripheral tissues led to the prevalence of thyroid dysfunction as reported in several *in vivo* and *in vitro* studies (Eirini, 2009). In the present study indicates the association thyroid dysfunction with type 2 DM is more predictable compare with the type 1 DM. Among all the population the incidence of subclinical hypothyroidism 25.3% (32) in type 2 DM and 16.2% (12) in type 1 DM. The incidence of clinical hyperthyroidism found to be very less among the thyroid dysfunctions (table.6.).

Table.6. Class of Thyroid dysfunction in diabetic and control group

Thyroid problem	Control (n=50)	Type 1 diabetics (n=74)	Type 2 diabetics (n=126)
Euthyroid	41(82.0)	54(72.9)	76(60.3)
Subclinical hypothyroidism	5(10.0)	12(16.2)	32(25.3)
Clinical hypothyroidism	2(4.0)	3(4.05)	6(4.7)
Subclinical hyperthyroidism	2(4.0)	4(5.4)	10(7.9)
Clinical hyperthyroidism	0(0)	0(0)	2(1.58)

4. CONCLUSIONS

The study results that the prevalence of thyroid dysfunction was found to be high among diabetic patients. The type 2 DM were found to be more in association with subclinical hypothyroidism compared with type 1 DM. Continuous monitoring of thyroid hormones is important to type 2 diabetes mellitus patients to control the prevalence of thyroid dysfunction.

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