Original Article

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Evaluation of Thyroid Function in Type 2 Diabetes Mellitus Patients

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Abstract

Background: The ability to diagnose and treat subclinical hypothyroidism in diabetic patients may greatly enhance the quality of life. The treatment of hypothyroidism helps in better control of other associated co-morbidities. Therefore, in present study association between thyroid dysfunction and Diabetes was assessed by correlating Fasting plasma glucose and Thyroid profile. *Materials and Methods:* A total of 40 subjects attending the OPD who were diagnosed for diabetes were recruited.40 normal age and sex matched participants were recruited as controls. Informed written consent was obtained from all the participants. Fasting plasma glucose was estimated by glucose oxidase method and TSH, T_3 and T_4 by enzyme-immunoassay (ELISA) method using commercially available kit. Subjects grouped as normal with TSH level0.39-6.16mIU/l, T_3 levels 52-185ng/dl and T_4 level as 5.0-15.0µg/dl. Lower T_3 and T_4 with high TSH is considered as Hypothyroidism and higher levels of T_3, T_4 with low TSH is considered as hyperthyroidism.The data was analysed using SPSS version 20. Unpaired t test and Pearson's correlation was performed to find the significant differences between the groups and their correlation. $P<0.05$ was considered as statistically significant. *Results:* The Chi-square test was used to find the association between diabetes and thyroid dysfunction showed significant association ($p<0.05$) between Diabetes and thyroid dysfunction. On comparison, showed no difference in the sugar levels according to dysfunction status($p<0.05$). *Conclusion:* A routine assessment of thyroid hormone levels in diabetics is necessary, particularly with subclinical thyroid hormones level.

Keywords: Fasting Plasma Glucose Level; Glucose Oxidase Method; TSH; T3; T4; Enzyme-linked Immunoassay.

Introduction

Diabetes mellitus is a common endocrine disorder rising in India and has reached approximately 20% in urban populations and approximately 10% in rural Population [1]. On long term it is associated with vascular complications these are responsible for increased morbidity and mortality among diabetic subjects [2]. New addition to these complications is the thyroid dysfunction which is indicated by the recent studies [3,4] The first report showing the association between diabetes and thyroid dysfunction was published in 1979 [5,6]. Since then a number of studies have estimated the prevalence of thyroid dysfunction among diabetes patients to be varying from 2.2 to 17%, the most common disorder being subclinical hypothyroidism [7,8]. However, few studies also estimated much higher prevalence of thyroid dysfunction in diabetes i.e., 31% and 46.5% respectively [9,10] also not showed any significant correlation between Fasting plasma glucose and thyroid profile parameters. Thyroid

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hormones directly control insulin secretion. In hypothyroidism, there is a reduction in glucose-induced insulin secretion by beta cells, and the response of beta cells to glucose or catecholamine is increased in hyperthyroidism due to increased beta cell mass. Moreover, insulin clearance is increased in thyrotoxicosis. Diabetes may affect the thyroid function to variable extent. Diabetes mellitus appears to influence thyroid function in two sites; first second at peripheral tissue by converting T_4 to T_3. Unrecognized thyroid dysfunction not only worsens the metabolic control but also impede the management of diabetes. Studies also have suggested that type 2 diabetes mellitus patients with subclinical hypothyroidism are at risk of complications like nephropathy and cardiovascular events.The ability to diagnose and treat subclinical hypothyroidism in these patients may greatly enhance the quality of life. Hence, there is need to detect such cases where hypothyroidism contributes to morbidity and where it is the cause for poor control of the associated conditions. The treatment of hypothyroidism helps in better control of other associated co-morbidities. So, patients with diabetes need to be screened for thyroid dysfunction. Therefore, in present study association between thyroid dysfunction and Diabetes was assessed by correlating Fasting plasma glucose and Thyroid profile.

Materials and Methods

In this study, a total of 40 patients attending the outpatient department of K.S. Hegde Charitable Hospital from June 2017 to November 2017 who were diagnosed for diabetes were recruited. Diagnosis of diabetes was based on the American Diabetes association criteria. 40 normal age and sex matched participants were recruited as controls. A medical history regarding the age at diagnosis of diabetes and current medication was obtained. The study protocol was approved by the institutional ethical committee. Informed written consent was obtained from all the participants.

Blood samples were drawn after 10-12 hours fast for measurement of fasting plasma glucose (FPS) and thyroid status. All the diabetic subjects were confirmed diabetics who had Fasting plasma glucose level > 126mg/dl and others were taken as control. The study excluded very ill patients with complication of Diabetes Mellitus.

Of the 4ml blood drawn from the subjects 2ml was dispensed into fluoride oxalate bottles for plasma glucose estimation and the rest of the blood sample was discharged into plain samples bottle and allowed to clot. Serum separated from the cells was stored at -20^{0}C and thawed only when required. Plasma from fluoride tubes was also stored at- 20^{0}C until needed for use. Fasting plasma glucose was estimated by glucose oxidase method and TSH, T_3 and T_4 by enzyme-immunoassay (ELISA) method using commercially available kit. Procedure wasfollowed as per the manufactures instructions. All the analysis was done in duplicate and the average of the duplicate data was used for calculation. The data obtained was classified as raised, low, or normal thyroid hormone levels were based on the following criteria. Subjects grouped as normal with TSH level0.39-6.16mIU/l, T_3 levels 52-185ng/dl and T_4 level as 5.0-15.0µg/dl. Lower $T_3$and T_4 with high TSH is considered as Hypothyroidism and higher levels of T_3, T_4 with low TSH is considered as hyperthyroidism.

Data analysis

The data was expressed as percentage and mean ±SD. Statistical analysis was performed using software statistical package for social sciences (SPSS) version 20, unpaired t test and Pearson's correlation was performed to find the significant differences between the groups and their correlation. $p<0.05$ was considered as statistically significant.

Results

For the study, 80 subjects, were recruited. Out of these 40 were males and 40 females. Further divided into diabetic and conntrol groups having 20 subjects in each group.Their age ranged between 40-75 years with mean age 57± 8 years (Figure 1).

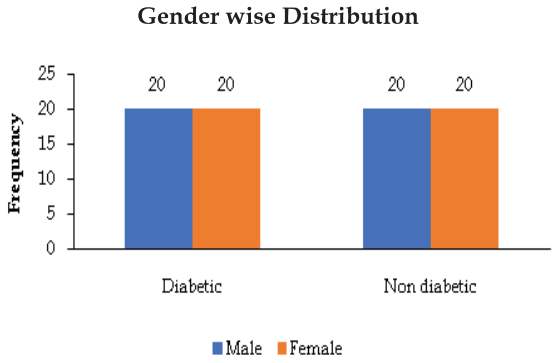

Fig. 1: Showing gender wise distribution

Thyroid hormones (TSH, T_3, T_4) levels were estimated for both the groups. Results revealed that 6 had abnormal thyroid levels. Of these 3 females had hypothyroidism and 2 had hyperthyroidism in diabetic group. In males only one had hypothyroidism in diabetic group (Figure 2). The Chi-square test was used to find the association between diabetes and thyroid dysfunction. The obtained p values are less than 0.05 and hence there was association between Diabetes and thyroid dysfunction (Table 1).

Unpaired t test was used to compare the difference in Fasting blood glucose levels. The obtained p value was less than 0.05 and hence there was a difference in the sugar levels (Table 2). It has been observed that, in control group the level of Fasting blood glucose was less (98.4±12) than the diabetic group (161±36). One-way ANOVA was used to compare Fasting blood glucose level according to the dysfunctional status. The obtained p value was > 0.05and hence there was no difference in the sugar levels according to dysfunction status (Table 3).

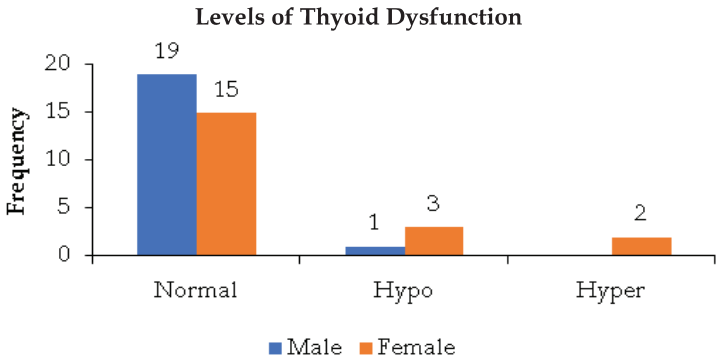

Fig 2: Showing levels of thyoid dysfunction in males and females.

Table 1: Thyroid dysfunction and thyroid hormone levels in diabetic and control group.

(n = 80)		Diabetes Frequency (%)	Control Frequency (%)	p value
Thyroid dysfunction	Hyper	13 (76.5)	4 (23.5)	0.003
	Hypo	13 (65)	7 (35)	
	Normal	14 (32.6)	29 (67.4)	
TSH(UNIT)	< 0.38	10 (76.9)	3 (23.1)	0.003
	0.39-6.16	17 (34.7)	32 (65.3)	
	> 6.17	13 (72.2)	35 (27.8)	
T3	< 51.9	9 (75)	3 (25)	0.011
	52-185	23 (39.7)	35 (60.3)	
	>185.1	8 (80)	2 (20)	
T4	<4.9	6 (85.7)	1 (14.3)	0.001
	5-15	18 (32.1)	38 (67.9)	
	>15.1	16 (94.1)	1 (5.9)	

Table 2: Comparison of fasting blood glucose among the groups.

	Mean	Standard deviation	p value
Diabetic	161	36.07	<0.001
Control	98.4	12.08	

Table 3: Comparison of Fasting blood glucose level according to the dysfunction status.

Group	Mean	Standard deviation	p value
Hyperthyroidism	170.5	2.12	0.667
Hypothyroidism	146.2	6.5	NS
normal	127.7	24.63	

Discussion

Among diabetic subjects investigated, 10% of the subjects had low levels of thyroid hormones while 5% had raised level. Non-diabetic subjects showed no thyroid dysfunction. This shows a high incidence of abnormal thyroid hormones level (high or low) in diabetic population. Pranav K Raghuvanshi [11] stated that total T_3 and total T_4 were significantly low, while serum TSH levels were higher in type 2 diabetes mellitus subjects as compared to the non-diabetic healthy subjects. Alok Mawar, K.P. Mishra et al. [12] concluded through their study that prevalence of hypothyroidism and subclinical hypothyroidism was found to be higher in type 2 diabetes mellitus subjects as compared to non-diabetic subjects. MJ Smithson [8] concluded from a study conducted amongst 11300 patients of which 223 were diabetic that the prevalence of undiagnosed thyroid disease in diabetic patients receiving community diabetes care was 5.5%.

Our finding is in agreement with Smithson [8], Suzuki et al [13]. They found altered thyroid hormones level of different magnitude in diabetic patients. Abnormal thyroid hormone level may be the outcome of various medications the diabetics was receiving. It is widely known that insulin [14] an anabolic hormone enhances the level of FT_4 while it suppresses the levels of T_3 by inhibiting hepatic conversion of T_4 to T_3. Likewise, the oral hypoglycaemic drugs such as sulfonylureas are known to suppress the levels of FT_4 and T_4 while causing raised levels of TSH. The presence of both raised and low thyroid hormone levels in diabetics in present study may be due to the modified thyroid releasing hormone (TRH) synthesis and its release [15] and may depend on the glycaemic status of the diabetics studied. Glycaemic status is influenced by insulin, which is known to modulate TRH and TSH level.

Conclusion

It was also observed that hypothyroidism was more in female subjects. Although it is possible that the magnitude and precision risk between diabetes and thyroid may be observed with a larger sample size and taking the medication into account.In conclusion routine assessment of thyroid hormone levels in diabetics is necessary, particularly with subclinical thyroid hormones level.Further studies are needed to establish the risk of thyroid dysfunction because the present study had low sample size.

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