

Study of Thyroid Dysfunction in Patients with Type 2 Diabetes Mellitus

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Abstract

Objective:

The prevalence of abnormal thyroid levels in diabetic population is not well established. We conducted a cross-sectional study to evaluate the incidence of thyroid dysfunction in patients with type 2 DM in a rural tertiary care hospital in Central India.

Method:

The study was conducted in the Medicine out patient department of a rural tertiary care hospital in Central India. The study population consisted of confirmed Type 2 DM (fasting >126mg/dl on two occasions or patients on anti-diabetic subjects) seen over a period of an year from Jan 2009 to Jan 2010. Blood glucose, thyroid stimulating hormone(TSH), total triiodothyronine (T3), total thyroxin (T4), lipid profile, blood urea, serum creatinine were examined in the study population.

Results:

We observed that 30 subjects (28.8 %) out of 104 patients had abnormal thyroid function. 20.19 % had hypothyroidism, 8.65 % had hyperthyroidism and rest of the diabetic population (75.16%) had euthyroid state.

Conclusion:

This study has shown that significant proportion of type II diabetics have thyroid dysfunction and have higher levels of blood lipids. Early detection of thyroid dysfunction will help in improving quality of life. Further controlled studies would be required to demonstrate this association.

Key Words: Thyroid dysfunction, Diabetes Mellitus, Association

Introduction

India has the largest number type 2 diabetes mellitus (T₂DM) cases in the world (40 million 2007) and this is predicted to increase to 70 million by the year 2025.⁽¹⁾ The influence of other endocrine and non endocrine organs other than pancreas on diabetic mellitus is documented^(2,3). Occasionally

other endocrine disorders such as hypothyroidism and hyperthyroidism are found in diabetes mellitus.⁽⁴⁾ The major alterations in thyroid hormone system are a reduction in the TSH stimulation at thyroid gland probably caused by central hypothyroidism and in peripheral generation of T₃ from T₄.⁽⁵⁾ Despite the high prevalence of diabetes in India there are not many studies to assess the association of thyroid dysfunction with diabetes. With this aim we decided to evaluate the prevalence of thyroid disorders prevalent in diabetics.

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Materials and Methods

The study was conducted in the Medicine out patient department of NKP Salve Medical College and Lata Mangeshkar Hospital, which is a rural tertiary care hospital in Central India from Jan 2009 to Jan 2010. Study was initiated after permission from institutional ethics committee.

All patients visiting the Medicine out patient department were screened for Type 2 DM by a random blood sugar testing. Those who were detected to have RBS more than 140mg/dl were further evaluated by fasting levels on two occasions. All the confirmed diabetic patients who had fasting blood glucose levels >126 mg/dL and who were receiving treatment such as insulin, oral hypoglycemic agent for Diabetes Mellitus were then enrolled in the study. All subjects were informed about the objectives of the study, and informed consent was obtained.

General health characteristics such as age, sex, smoking habits, duration of DM were investigated by a self-administered questionnaire. Each diabetic patient was physically examined to rule out thyroid dysfunction. Patients of type 1 diabetics, patients with malignant thyroid disease, patients who have undergone thyroid surgery, patients who were on drugs that are known to modify the thyroid function, patients on thyroxine therapy for hypothyroidism, patients on anti-thyroid drugs like methimazole, patients who had undergone exposure to radiation of the thyroid gland were excluded. Classification of the value into raised, low or normal thyroid hormone level was based on following criteria. Subjects classified as having raised level as thyroid hormone ($T_4 > 10.8 \mu\text{g/dl}$, $T_3 > 1.9 \mu\text{g/dl}$ and $\text{TSH} < 0.5 \mu\text{g/dl}$). Those classified as having low levels had ($T_4 < 4.4 \mu\text{g/dl}$, $T_3 < 0.52 \mu\text{g/dl}$ and $\text{TSH} > 5 \mu\text{g/dl}$). Serum levels were estimated by Chemiluminescence Immunoassay (CLIA) method using LUMAX by Monobind Inc. USA machine.

Results

A total of hundred and four subjects with type 2 diabetes mellitus were enrolled in the study. The mean age of diabetic patient was 51.6 ± 11.6 SD years and BMI was 23.89 ± 5.67 SD kg/m^2 . Clinical and biological characteristic of the study population are shown in (table 1). Among the hypothyroid population (n=21) mean BMI was found to be 27.4 ± 3.87 SD kg/m^2 . Various biochemical parameters seen in study subjects are mentioned in (Table 2). Diabetic patients were distributed into high, low and euthyroid hormone levels. Out of 104 diabetic subjects studied, 20.19% had low thyroid hormone, 8.65 % had high thyroid levels (n=9) while 75.16 % patients had euthyroid hormone levels. Low thyroid hormone levels were higher in females while high thyroid hormone levels were higher in males (Table 3). Almost 31.7% (n=33) diabetic patients showed hypercholesterolemia (Table 4).

Discussion

All over the world researchers have found that there is higher incidence of thyroid dysfunction among diabetic patient. Although the prevalence is more in cases of type I diabetics, a significant prevalence is also found in type 2 diabetic population which is far higher than found in general population.⁽⁶⁾

Among 104 diabetic subjects investigated in our study 20.19 % had high level of TSH and 8.65 % had low level of TSH. In a study by Papazafiropoulou et al they reported a prevalence rate of 12.3% thyroid dysfunction.⁽⁷⁾ A study by Smithson et al. showed a prevalence of 10.8% of thyroid dysfunction in diabetic patients.⁽⁸⁾ Another study by Perros et al in a randomly selected group of 1,310 diabetic adults estimated that the prevalence of thyroid dysfunction was found 13.4%.⁽⁵⁾ A study done by Akbar et al in Saudi Arabia reported that thyroid dysfunction was present in 16% of type 2 DM patients.⁽⁹⁾ Also, a

study in Jordan showed that the overall prevalence of thyroid dysfunction was 12.5% in type 2 DM patients.⁽¹⁰⁾ The findings in our study are consistent with the results of studies in different geographic areas.

The incidence of hyperthyroidism was lower in female (3.8 %) than in male (5 %), but hypothyroidism occurred more in female diabetics (15.3 %). We found that a higher prevalence of hypothyroidism (20.19%) in our study population. It is well established that hypothyroidism is more common in diabetic females. In a study by Perros et al. the prevalence of thyroid dysfunction was 10.9% in females and 6.9% in males.⁽⁵⁾ The NHANES III study reported that the prevalence of subclinical hypothyroidism was 3.4% in males and 5.8% in females.⁽¹¹⁾ In addition, a study in 420 adult females with T2D randomly selected from participants in the community-based Fremantle Diabetes Study showed that the prevalence of subclinical hypothyroidism was 8.6%.⁽¹²⁾ Finally, a recent study revealed that the prevalence of subclinical hypothyroidism was 5.2% in males and 8.4% in females with Type 2 DM.⁽¹³⁾ These findings are probably associated with the higher prevalence of obesity recorded in female diabetic.

In contrast, hyperthyroidism causes insulin resistance and may unmask impaired glucose tolerance and diabetes in previously undiagnosed patients.⁽¹⁴⁾ Typically, blood glucose levels are abnormal and trend towards hyperglycemia until treatment is initiated. After the thyroid function stabilizes, the glucose levels usually improve.

Diabetic mellitus and thyroid disease are the two common endocrinopathies seen in adult population. Insulin and thyroid hormone are intimately involved in cellular metabolism and thus excess or deficit of either one of these hormones could result in the functional

derangement of the other. In euthyroid individual with diabetic mellitus the serum T3 level, basal TSH level and TSH response to thyrotrophin releasing hormones (TSH) may all be strongly influenced by Glycemic status.⁽¹⁴⁾

Poorly controlled diabetic both Type I & type 2 may induce T₃ state characterized by low serum total & free T3 level, increase in reverse T₃ (rt₃) but near normal serum T₄ & TSH concentration.⁽¹⁵⁾ Low serum T3 is due to reduced peripheral conversion of thyroxin T₄ to triiodo thyronine (T3) via 5 monodeiodination reaction. Poorly controlled diabetic may also result in impaired TSH response to TRH or loss of normal nocturnal TSH peak.

The thyroid hormone T₃, T₄ are insulin antagonist that also potentate the action of insulin indirectly.⁽¹⁶⁾ TRH synthesis decrease in diabetic⁽¹⁷⁾ and this could be responsible for occurrence of low thyroid hormones levels in diabetics. The abnormal thyroid hormone level may be the outcome of various our medication that diabetics were receiving. For example it is known that insulin was anabolic hormone. It enhances the level of T₄ while it suppress the level of T₃ by inhibiting hepatic conversion of T₄ to T₃, on the other hand some of the oral hypoglycemic agent such as phenylthiourea are known to suppress the level of T₃ & T₄ while raising the level of TSH.⁽¹⁹⁾ The presence of both high & low level of thyroid hormones in diabetic may also be due to modified TSH synthesis and release and may depend on the glycemic states of diabetic patient.

There were certain limitations in our study. As the study population comprised of a hospital population it is difficult to extrapolate the data to the general population. Also as the sample size was small it might be likely that we have overestimated the actual prevalence. With the number of diabetics attending our OPD we would have needed a longer duration study to overcome

this limitation. We did not have a controlled sample to compare the prevalence in matched population of diabetics. This could have helped to assess the actual prevalence of thyroid dysfunction. Due to financial restraints we could not evaluate the causes of thyroid dysfunction in all the patients who were found to have abnormalities. Only those patients (n=4) who were willing for further evaluation were studied for the cause.

Failure to recognize the presence of abnormal thyroid hormone levels in diabetes may be a primary cause of poor management often encountered in some treated diabetics. There is

therefore need for the routine assay of thyroid hormones in diabetics, particularly in those patients whose conditions are difficult to manage. This study has shown a high incidence of abnormal thyroid hormone levels among diabetic patients. The incidence of hyperthyroidism was lower in female (n=4) than in male (n=5), but hypothyroidism occurred more in female diabetics (n= 16 vs n=5).

In conclusion, our findings demonstrate that detection of abnormal thyroid hormone levels in addition to other biochemical variables in the early stage of diabetes will help patients improve their health and reduce their morbidity rate. Further controlled studies would be required to demonstrate this association.

Table 1: Clinical and biological profile of patients of diabetes mellitus

Demographic Parameters.	
Age	51.6 ± 11.6 SD years
Sex	Male -41, females-63
Smoking	18%
HT	12.5%
BMI (kg/m ²)	23.89 ± 5.67SD

Table 2:- Biochemical changes in study population

Investigations	Values
Fasting blood glucose (mg/dL)	151 ± 53 SD
Post-meal blood glucose (mg/dL)	242 ± 73.7SD
Blood urea (mg/dl)	31 ± 8.1
Serum creatinine (mg/dl)	0.9 ± 0.2 SD
Total cholesterol (mg/dl)	176.57 ± 40.14SD
Triglycerides (mg/dl)	129.5 ± 40.3 SD
LDL (mg/dl)	96.6 ± 37.7SD
HDL (mg/dl)	40.1 ± 9.87SD

Table 3: - Distribution of thyroid dysfunction in Study population according to gender

Thyroid disorder	Male	Female	Total
Hypothyroidism	3	16	21
Hyperthyroidism	5	4	9

Table 4: - Distribution of thyroid dysfunction in Study population according to age

Thyroid disorder	20-40yrs	40-60yrs	>60 yrs
Hypothyroidism	5	11	5
Hyperthyroidism	2	4	3

Table 4: - Distribution of Mean Lipid levels in subjects with thyroid dysfunction

Thyroid disorder	Mean Chol mg/dl	Mean TG mg/dl	Mean LDL mg/dl	Mean HDL mg/dl
Hypothyroidism	194.5 ± 36.1	138.1 ± 53.8	83.6 ± 33.1	38.5 ± 3.17
Hyperthyroidism	172.2 ± 33.6	111.5 ± 17.16	89.1 ± 34.4	35.4 ± 11.6

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