

Subclinical Hypothyroidism in type 2 diabetes mellitus patients

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Abstract:

Introduction: Diabetes mellitus (DM) is the most common metabolic disease and its prevalence is increasing rapidly. Studies have reported that there is thyroid dysfunction in Type 2 Diabetes Mellitus patients. Subclinical hypothyroidism (SCH) is the most common in diabetes mellitus patients. The present study aims to evaluate the subclinical hypothyroidism in type 2 diabetes mellitus patients. **Materials & methods:** This, cross sectional case-control study, conducted in Department of Physiology in association with Department of Endocrinology, JNU Institute for Medical Sciences & Research Center, Jaipur. A total of 45 ambulatory type 2 diabetes mellitus patients were taken as cases and 45 healthy subjects served as controls. After taking aseptic precautions fasting venous blood samples were collected from the study subjects. Three ml of blood was collected in plain tubes and 2 ml of blood was collected in EDTA tubes. Serum was used for the estimation of fasting blood sugar (FBS) by using ERBA chemistry analyzer. FT3, FT4 and TSH by ELISA method, using mini VIDAS and EDTA sample is used for estimation of HbA1c by using BIORAD-D10. Data were expressed as mean \pm SD. P value <0.05 is considered as statistically significant. **Results:** In the present study, FBS, HbA1c, TSH levels were significantly increased in type 2 diabetes mellitus patients compared with the controls. FT3 and FT4 levels were not significant. There is a non significant weak positive correlation between HbA1c and TSH. **Conclusion:** In the present study, plasma levels of TSH levels were significantly increased in T2DM patients compared to normals and FT3, FT4 levels were normal which suggests that there is a subclinical hypothyroidism in type 2 Diabetes Mellitus Patients.

Key words: Diabetes mellitus, Hypothyroidism, Glycated hemoglobin

Date of Submission: 08-12-2018

Date of acceptance: 24-12-2018

I. Introduction

Diabetes mellitus (DM) is the most common metabolic disease and its prevalence is increasing rapidly [1,2]. Diabetes mellitus is characterized by hyperglycemia resulting from impaired insulin secretion or action and/or both. Globally, the prevalence is predicted to be 11.1% in 2033, affecting 600 million people. Thus it is increasing the burden to healthcare services and increases the healthcare costs [3,4]. The increased prevalence of diabetes is mainly due to increasing population, aging, urbanization, obesity and lack of physical exercise [5,6]. In India, the prevalence of diabetes mellitus is increasing, with highest number of diabetic people termed as "Diabetes capital of the world". It affects 6.5 to 19.5% of the adult Indians [7,8].

Studies have reported that there is thyroid dysfunction in Type 2 Diabetes Mellitus patients [9]. Thyroid disorders are also very common among general population and is the second most common endocrine disorder after diabetes mellitus. Thyroid disease, adversely affects diabetic control [10-11].

Subclinical hypothyroidism (SCH) is the most common in diabetes mellitus patients, followed by subclinical hyperthyroidism, overt hypothyroidism and overt hyperthyroidism [3]. Subclinical hypothyroidism (SCH) is characterized by high serum concentrations of thyroid-stimulating hormone (TSH) with normal circulating free thyroid hormone concentrations and clinically asymptomatic. Subclinical hypothyroidism prevalence in diabetes mellitus patients is reported to be 10%-17% [3]. Patients with SCH have increased risk of metabolic syndrome (MetS), atherosclerosis, cardiovascular diseases, and mortality. Undiagnosed thyroid dysfunction may affect metabolic control and enhance cardiovascular, and other chronic complications in diabetic patients [12].

Type 2 diabetes mellitus and thyroid dysfunction are chronic diseases which frequently require lifelong follow-up and treatment. Both the diseases have long lasting effects on cardiovascular health and mortality. Subclinical hypothyroidism of moderate severity is associated with higher risk of heart failure and stroke in the younger population [13].

Thyroid dysfunction screening is recommended in Type 1 diabetes mellitus patients according to guidelines of the American Thyroid Association (ATA) [14]. However, there is lack of definitive guidelines for screening of thyroid dysfunction in T2DM. It is important to recognize the interdependent relationship between thyroid disease and diabetes. The present study aims to evaluate the subclinical hypothyroidism in type 2 diabetes mellitus patients.

II. Materials & Methods

This study is a cross sectional case-control study, conducted in Department of Physiology in association with Department of Endocrinology, JNU Institute for Medical Sciences & Research Center, Jaipur. A total of 45 ambulatory type 2 diabetes mellitus patients were taken as cases and 45 healthy subjects served as controls. Patients with type 1 diabetes mellitus, chronic liver disease, patients on hepatotoxic drugs, alcoholism, autoimmune diseases, congestive cardiac failure and renal diseases were excluded from the study. The clinical history and other necessary details were obtained from the patients records.

After taking aseptic precautions fasting venous blood samples were collected from the study subjects. Three ml of blood was collected in plain tubes and 2 ml of blood was collected in EDTA tubes. Samples were left for 20 minutes at room temperature, and centrifuged at 3000 rpm for 5 minutes. Serum was used for the estimation of fasting blood sugar (FBS) by using ERBA chemistry analyzer. FT3, FT4 and TSH by ELISA method, using mini VIDAS and EDTA sample is used for estimation of HbA1c by using BIORAD-D10. The study is approved by the institutional Ethical Committee and informed consent was obtained from the study participants.

Statistical Analysis:

Data were expressed as mean \pm SD. P value <0.05 is considered as statistically significant. Spearman's rho correlation used for correlation between TSH and HbA1c. Statistical analysis was done by using SPSS 20.0, Stata 8.0.

III. Results

In the present study, FBS, HbA1c, TSH levels were significantly increased in type 2 diabetes mellitus patients compared with the controls. FT3 and FT4 levels were not significant. There is a non significant weak positive correlation between HbA1c and TSH, as illustrated in the table 1 and 2.

Table 1: Comparison of study parameters between T2DM cases and controls

Parameters	Controls (n=45) Mean \pm SD	T2DM (n=45) Mean \pm SD	p Value
Fasting Blood sugar (mg/dL)	114.0 \pm 15.19	249.09 \pm 69.51	<0.001*
Glycated Hemoglobin (%)	6.29 \pm 0.23	8.65 \pm 1.46	<0.001*
FreeT3 (pg/mL)	3.55 \pm 1.07	3.41 \pm 1.01	0.404
Free T4 (ng/dL)	1.18 \pm 0.23	1.19 \pm 0.47	0.184
TSH (μ IU/mL)	2.98 \pm 1.04	5.82 \pm 1.37	<0.001*

* Statistically significant

Table 2: Spearman's rho correlation between HbA1c and TSH

Parameter	Correlation Coefficient (r)
HbA1c	0.114**

**Correlation is significant at the 0.01 level (2-tailed).

IV. Discussion

In the present study, FBS, HbA1c and TSH levels were significantly increased in T2DM subjects when compared to control group and FT3 and FT4 levels were not significant. Studies have reported that subclinical hypothyroidism is recognized as insulin resistant states [15].

Subclinical hypothyroidism is defined as a serum thyroid-stimulating hormone (TSH) level above the upper limit of normal despite normal levels of serum free thyroxine [16]. SCH is a common problem, with a prevalence of 3-8% in the general population without known thyroid disease. The prevalence of subclinical hypothyroidism is increases with age and is higher in women. Anti-thyroid antibodies can be detected in 80% of patients with SCH [17].

Perros et al. [18] reported that the prevalence of thyroid disease in diabetics is 13.4%. Celani et al. [19] reported that the prevalence of thyroid disease in T2DM was 31.4%, out of which SCH was most common form (48.3%). Fernandez-Real et al. [20] reported that thyroid function tests are intrinsically linked to variables of insulin resistance and endothelial function, therefore implying the possibility that underlying factors leads to high serum TSH, insulin resistance, dyslipidemia and endothelial function [17].

Thyroid hormones play an important role in the glucose homeostasis by causing modifications in the circulating insulin levels and counter-regulatory hormones, intestinal absorption, hepatic production and glucose uptake by peripheral tissues [21]. The excess or deficiency of either insulin or thyroid hormones can cause functional impairment of other. Insulin regulates the thyroid metabolism mainly at the level of hypothalamus controlling the release of TSH release and secondarily at peripheral tissue level by converting T4 to T3. Hyperglycemia in T2DM causes decrease in hepatic concentration of T4-5 deiodinase, low serum concentration of T3, raised levels of reverse T3 and low, normal, or high level of T4 leading to altered thyroid status. A variety of thyroid abnormalities are found to coexist with diabetes mellitus. It is evident that thyroid dysfunction and diabetes mellitus are associated [22].

In hypothyroidism, glucose homeostasis is also affected although its clinical impact is less obvious. Decreased glucose disposal has been proved in hypothyroid patients. Insulin resistance has been also reported in subclinical hypothyroidism, adding one more possible mechanism to the association of sub-clinical hypothyroidism and complications of diabetes mellitus [17].

V. Conclusion

Globally, the prevalence of type 2 diabetes mellitus is increasing; it has become a major public health concern in the 21st century. In the present study, plasma levels of TSH levels were significantly increased in T2DM patients compared to normals and FT3, FT4 levels were normal which suggests that there is a subclinical hypothyroidism in type 2 Diabetes Mellitus Patients. SCH is common among type 2 diabetic patients, especially in females. It is most commonly secondary to autoimmune thyroid disease. Microvascular complications are commonly observed in this group of patients with dual endocrinal disorder treating physicians should routinely screen SCH in patients with diabetes mellitus to prevent complications. Hence screening for Sub-clinical hypothyroidism in type 2 DM subjects will help to identify the microvascular complications at an earlier stage & hence preventing morbidity and mortality.

Conflict of Interest: Nil

Acknowledgements: Nil

Funding: Nil

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Dr. Suresh Nayak Basavanayak. "Subclinical Hypothyroidism in type 2 diabetes mellitus patients". IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 17, no. 12, 2018, pp 25-28.