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The Study of Thyroid Dysfunction among Type 2 Diabetic Patients

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A B S T R A C T

Diabetes mellitus (DM) and thyroid dysfunction are the two most common endocrinopathies seen in general population. Type 2 diabetes mellitus is commonly associated with altered thyroid function. Aim of the present study is to reveal the prevalence of thyroid dysfunction in patients of Type 2 diabetes mellitus. In the present study 50 type 2 diabetic subjects and 50 healthy non diabetic subjects were investigated for fasting plasma glucose (FPG), glycosylated haemoglobin (HbA1c), total tri-iodo-thyronine (T3), total thyroxine (T4), free tri-iodo-thyronine (FT3), free thyroxine (FT4) and thyroid stimulating hormone (TSH). Out of the 50 type 2 diabetic subjects studied, 25.11% showed abnormal thyroid function (21.90% had hypothyroidism and 3.21% had hyperthyroidism) and 74.89% showed normal thyroid hormone level. The ability to diagnose and treat unsuspected hypothyroidism in type 2 diabetic patients may result in better control of the diabetic state, thereby greatly enhancing the quality of life. This study justifies the view that all type 2 diabetic patients should be screened for hypothyroidism.

Introduction

Diabetes mellitus (DM), a leading cause of death worldwide, is one of the most challenging health problems in the 21st century (Faghilimnai *et al.*, 2006; Gurjeet *et al.*, 2011). The prevalence of diabetes mellitus in West is between 6 and 7.6 %. India has already become the "diabetes capital" of the world with over 3 crores affected patients. Between 1995 and 2025, this is predicted to be a 35% increase in the worldwide prevalence of diabetes. The rising number of people with diabetes will occur mainly in populations of developing countries, leading to more than 300 million people with diabetes globally by 2025 (Shonima and Uma, 2010).

Thyroid diseases and diabetes mellitus are

the two most common endocrinopathies encountered in clinical practice. Diabetes and thyroid disorders have been shown to mutually influence each other and an association between these two conditions has been reported in literature (Celani *et al.*, 1994) The report showing the association between diabetes and thyroid dysfunction were first published in 1979 (Udoing *et al.*, 2007). Since then a number of studies have estimated the prevalence of thyroid dysfunction among diabetic patients which ranges from 2.2 to 17% (Perros *et al.*, 1995; Gray *et al.*, 1980). However, a much higher prevalence of thyroid dysfunction in diabetes has been estimated by fewer studies i.e. 31 % and 46.5% respectively (Gray *et al.*, 1980; Maxon *et al.*, 1975). Diabetic patients have a higher prevalence of thyroid disorders compared to the general population (Meara *et al.*, 1993).

Thyroid function tests are especially recommended in patients with clinical suspicion and / or unexplained changes in diabetic metabolic control or serum cholesterol and weight gain. The treatment of thyroid dysfunction helps better control of other associated conditions. The ability to diagnose and treat unsuspected hypothyroidism in these patients may greatly enhance the quality of life. Hence the need to detect such cases where hypothyroidism contributes to delayed recovery and where it is the cause for poor control of the associated conditions (Dimitriadis *et al.*, 1985).

Materials and methods

Study was done for a period of six month in Sri Lakshmi Narayana Medical College & Hospital. Study includes a total of 100 subjects divided into 2 groups – 50 cases and 50 controls. Informed consent was taken from both cases and controls and the study was approved by the institutional ethical and research committee.

The study population consisted of total of 50 Type 2 diabetic patients (35 females and 15 males) and 50 non diabetic subjects (40 females and 10 males) with mean age of 43.45 ± 3.18 and 41.77 ± 2.53 respectively. The non-diabetic volunteers without history of diabetes mellitus whose FPG was less than 110 mg /dl on two occasions were the control subjects. These volunteers included non-diabetic subjects who came in the hospital for routine check-ups as advised by their attending physicians. The controls were not on any drugs. The diagnosis of DM was based on the American Diabetes Association criteria for type 2 DM (fasting plasma glucose level higher than 126 mg/dl and/or glucose level exceeding 200 mg/dl at 2 hours in the 75 g oral glucose tolerance test).

Laboratory Data

Venous blood sample was withdrawn and assayed for thyroid function (T3, T4, FT3, FT4, and TSH) and for the glycaemic status (FPG, HbA1c).

The following guidelines for detection of thyroid dysfunction were considered –

1) Normal – when FT3, FT4, T3, T4 and TSH were within the normal range.
2) Primary hypothyroidism – when TSH is more than 5.2 μIU/L and FT3, FT4, T3, T4 is less than the normal value.
3) Primary hyperthyroidism - when TSH is less than 0.2 μIU/L and FT4, FT3, T3, T4 is more than the normal values.
4) Subclinical hypothyroidism – when TSH is more than 5.2 μIU/L and FT3, FT4, T3, T4 is within the normal range.
5) Subclinical hyperthyroidism – when TSH is less than 0.2 μIU/L and FT3, FT4, T3, T4 are within the normal range.

Statistical analysis

The results obtained and expressed in mean ± SD. The comparison was done by student t test and statistical analysis of each parameter was done by SPSS statistical package version 15.0. p value < 0.05 was considered statistically significant.

Results and Discussion

The present study was conducted on 50 subjects aged between 30 and 60 years. This case control study has diagnosed 50 type 2 diabetic patients of both genders who were on treatment with no known complications and no history of previous thyroid disease (Table 1).

Table 2 shows the level of various laboratory parameters in diabetic and non-diabetic subjects. FPG and HbA1c were significantly higher in diabetic patients as compared to the non-diabetic subjects. The serum levels of T3, T4, FT3 and FT4 were significantly lower in diabetic subjects as compared to the non-diabetic subjects while level of serum TSH was significantly higher in diabetic subjects as compared to the non-diabetic subjects.

Table 3 shows the distribution of thyroid disorder according to the gender in type 2 diabetes mellitus and non-diabetic control subjects. Out of the 50 type 2 diabetic subjects studied, 25.11% showed abnormal thyroid function (21.90% had hypothyroidism and 3.21% had hyperthyroidism) and 74.89% showed normal thyroid hormone level. The incidence of hypothyroidism was more in females as compared to the males in type 2 diabetes (males 13.5 %, females 32.50 %). Hypothyroidism was present in 21.90% patients, of which 13.75% had subclinical hypothyroidism and 8.15% had primary hypothyroidism. The results of the present study were in accordance with the reports who in separate studies found altered thyroid hormone level (both low and high) in a diabetic patient (Kemp *et al.*, 1997).

Table.1 Sex and age wise distribution of diabetic and non-diabetic controls

Groups	Female	Male	Mean ages
Non-diabetic controls	40	10	41.77 ± 2.53
Diabetic subjects	35	15	43.45 ± 3.18

Table.2 Levels of various biochemical parameters in diabetic and non-diabetic subjects

Parameters measured	Normal values	Non diabetic control group (n=50)	Type 2 diabetic (n = 50)
FPG	70-110mg/dl	83.80±5.821	170.95± 4.006**
HbA1c	4.2 – 6.2 %	5.18 ± 0.175	7.572 ± 0.195**
Free T3	1.5-4.2 pg /ml	3.00 ± 0.066	2.174 ± 0.053*
Free T4	0.8-1.68 ng/dl	1.243 ±0.047	1.044 ± 0.049*
T3	70-210 ng/dl	144.141 ± 4.792	114.083 ± 7.266*
T4	5.2-11.8 µg/dl	8.365 ±0.2105	7.524 ± 0.261*
TSH	0.2-5.2 µIU/ml	3.883 ±0.283	7.6006 ± 1.276***

*-significant **-highly significant

Table.3 Type of thyroid disorders according to gender in type 2 diabetic and non- diabetic control group

Distribution of subject according to gender	Subclinical hypothyroidism	Primary hypothyroidism	Subclinical hyperthyroidism	Primary hyperthyroidism
Type 2 DM Female (N = 35)	2	7	0	1
Type 2 DM male(N = 15)	1	1	0	0
Non Diabetic Female(N=40)	1	0	0	0
Non Diabetic male(N = 10)	2	0	0	0

The present case control study was carried out at Sri Lakshmi Narayana Medical College and Hospital, Puducherry. It included total 100 subjects equally divided between type 2 diabetes mellitus and non-diabetic healthy subjects. Age and sex matched controls were selected those who had no evidence of any disease clinically.

The thyroid hormones are insulin antagonists that also potentiate the action of insulin indirectly. 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 type 2 diabetes mellitus subjects than in non-diabetics healthy subjects. Results obtained from present study have shown that in type 2 diabetes mellitus, hypothyroidism is frequently observed. Present study found significant correlation between FPG and T3 & TSH which needs further research for confirmation.

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 (Sol´a *et al.,* 2002; Bhattacharyya and Wiles, 1999). Thyroid function tests are especially recommended in patients with clinical suspicion and/or unexplained changes in diabetic metabolic control or serum cholesterol and weight gain. The treatment of hypothyroidism helps in better control of other associated co-morbidities. The ability to diagnose and treat subclinical hypothyroidism in these patients may greatly enhance the quality of life. The relationship between diabetes mellitus and thyroid disorders is characterized by a complex interdependent interaction. Furthermore, it seems that unidentified thyroid dysfunction could negatively impact diabetes and its complications. A higher frequency of retinopathy and nephropathy was observed in diabetic patients with subclinical hypothyroidism, and more severe retinopathy was noted (Singer 2001; Den Hollander *et al.*, 2005; Yang *et al.*, 2010).

Therefore, management of subclinical hypothyroidism in patients with diabetes may prove beneficial. We conclude that a systematic approach to thyroid testing in diabetic subjects is desirable; particularly in those patients whose associated conditions are difficult to manage. The treatment of hypothyroidism helps in better control of other associated conditions. Hence the need to detect such cases where hypothyroidism contributes to morbidity and where it is the cause for poor control of the associated conditions.

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