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Exploration of Thyroid Profile Among The Type 2 Diabetics: A Hospital Based Study

KEYWORDS: Thyroid hormones, Type 2 diabetics, Sub-clinical hypothyroidism.

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ABSTRACT *Autoimmune thyroid diseases are prevalent among type 1 diabetes patients. Both hypothyroidism and hyperthyroidism have been reported among type 2 diabetics in various studies. With this background, a cross sectional hospital based study, designed to estimate the thyroid hormones among type 2 diabetes patients and to find out the correlation of thyroid hormones with various biochemical parameters among diabetics, was conducted with patients of type 2 diabetes as cases and age & sex matched healthy volunteers as controls. Plasma glucose, HbA1c, serum T3, T4, and TSH were measured and analyzed by mean, standard deviation and correlation coefficient in SPSS. Only serum TSH level was found to be significantly high among patients having high blood glucose and HbA1c level. The study revealed that there is significant rise of TSH level among diabetic patients; but presence of sub-clinical hypothyroidism among diabetics requires a better sample size.*

Introduction

Thyroid diseases and diabetes mellitus are the two most common endocrine disorders encountered in clinical practice. Most common form of diabetes is Type 2 diabetes (T2D). The prevalence of T2D is increasing worldwide (Bertoni *et al.*, 2008) [1]. Diabetes mellitus is characterized by chronic hyperglycemia resulting from various environmental and genetic factors acting simultaneously or jointly. The prevalence of Type 2 diabetes is rising in India and has reached approximately 20% in urban populations and approximately 10% in rural populations (Ramachandran *et al.*, 2009) [2].

Thyroid hormones play an indispensable role in various metabolic processes like carbohydrate metabolism, lipid metabolism and pancreatic function (Fernandez-Real *et al.*, 2006) [3]. Alteration of thyroid hormones directly affects the basal metabolic rate.

Patients with T2D commonly display the symptoms of hypothyroidism, and symptoms of hyperthyroidism have been documented in patients with type 1 diabetes (Patricia, 2000) [4], (Engler *et al.*, 1992) [5].

Excess or deficiency of either insulin or thyroid hormones can result in functional abnormalities of one another, as both of them are closely involved in cellular metabolism.

Some studies have suggested that type 2 diabetic patients with subclinical hypothyroidism are at risk of complications like nephropathy and cardiovascular events (Chen *et al.*, 2007) [6].

In light of the above facts, the study was designed to estimate the proportion of thyroid dysfunction in a T2D population and to evaluate the association between thyroid dysfunction with diabetes.

Aim and objectives

- To estimate the proportion of thyroid dysfunction among the Type 2 diabetes patients attending hospital OPD.
- To find out the correlation of thyroid hormones with the various biochemical parameters of serum glucose level (fasting, post-prandial and HbA_{1C}) among the Type 2 diabetics.

Materials and methods

This cross sectional observational study was conducted in Hi-Tech Medical College and Hospital, Bhubaneswar. Here Patients attending OPD of Dept. of Medicine with Type 2 Diabetes were taken as cases. Age & sex matched healthy volunteers were taken as controls. After obtaining informed consent, patients attending OPD of Dept. of Medicine were screened for Type 2 Diabetes as per International Diabetic Federation definition [7]. Those found to have Type 2 Diabetess were recruited in the study as cases. About 50 cases & 30 controls will be included in the study. The data were collected from 01.01.2013 to 01.06.2013.

Fasting and post-prandial plasma glucose levels were estimated by glucose oxidase-peroxidase method, HbA_{1c} level was measured by chromatographic technique and thyroid hormones (Serum T_3, T_4 and TSH) were estimated by automated immunoassay.

Data were analyzed by using software package (IBM SPSS Statistics, version 20.0). Data were summarized initially by calculating mean & standard deviation. They were tested for significance by chi-square, student t test as & when required. P value less than 0.05 was taken as significant.

The study was approved by the Institutional Ethics Committee for Human Research of Hi-Tech Medical College & Hospital, [No: HMCH/IEC/13/1228(8)], Bhubaneswar.

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Result

50 patients with type 2 diabetes were taken as cases and age & sex matched 30 healthy volunteers were taken as controls. The mean & SD of thyroid profile (T_3, T_4 and TSH) amongst diabetic (case) and non-diabetic (control) group are given below (Table 1).

Table 1: Summarized thyroid profile between diabetic and non-diabetic groups.

Thyroid Profile	Diabetic (n=50)			Non-diabetic (n=30)	
	Mean	SD		Mean	SD
T3	1.80	0.30		1.76	0.30
T4	92.47	16.89		90.50	16.23
TSH	11.77	4.31		7.49	5.22

Mean difference, t-value, P value and confidence interval of thyroid profile between case & control groups is summarized in Table 2.

Table 2: Comparison of thyroid profile between case (diabetic; n= 50) and control (non-diabetic; n= 30) groups.

Thyroid Profile	Mean Diff.	t –value	P value	95% CI	
				Lower	Upper
T3	0.04	0.575	0.567	-0.10	0.18
T4	1.97	0.523	0.603	-5.53	9.46
TSH	4.28	3.989	< 0.001	2.14	6.41

Statistical correlation analysis between glycemic parameters (FBS, PPBS & HbA_{1c}) & thyroid hormones is summarized in Table 3.

Table 3: Statistical correlation (with significance) between glycemic parameters & thyroid hormones in diabetics.

Thyroid hormones	FBS	PPBS	HbA_{1c}
T_3	r= 0.151 P= 0.181	r= 0.151 P= 0.181	r= 0.176 P= 0.118
T_4	r= 0.157 P= 0.164	r= 0.142 P= 0.209	r= 0.209 P= 0.063
TSH	r= 0.346 P= 0.002	r= 0.284 P= 0.011	r= 0.767 P< 0.001

Discussion

The co-existence of both diabetes and thyroid disorders has been associated with increased long-term morbidity and mortality. The impact of thyroid alterations on glucose metabolism has been known for a long time. Thyroid disorders are more prevalent in people with type 1 diabetes due to common autoimmune origin. But similar prevalence of thyroid disease has also been reported in type 2 diabetes. There are several international studies on the relationship between thyroid disease and type 2 diabetes, but very few studies was done in India.

Table 1 shows increased mean value of serum T_3, T_4 and TSH in diabetics as compared to non-diabetics. Table 2 indicates significant increased level serum TSH in diabetics ($P < 0.001$) as compared to non-diabetics. Table 3 shows significant correlation of serum TSH with all the glycemic parameters i.e. FBS ($P = 0.002$), PPBS ($P = 0.011$) and HbA_{1c} ($P < 0.001$) in diabetics.

Thyroid hormones exert profound effects in the regulation of glucose homeostasis. These effects include modifications of circulating insulin levels and counter-regulatory hormones, intestinal absorption, hepatic production and peripheral tissues (fat and muscle) uptake of glucose. It has long been known that thyroid hormones act differentially in liver, skeletal muscle and adipose tissue – the main targets of insulin action. While thyroid hormones oppose the action of insulin and stimulate hepatic gluconeogenesis and glycogenolysis (Raboudi N *et al*, 1989) [8], (Weinstein SP *et al*, 1994) [9], they up-regulate the expression of genes such as GLUT-4 and phosphoglycerate kinase, involved in glucose transport and glycolysis respectively, thus acting synergistically with insulin (Viguerie N *et al*, 2002) [10], (Clement K *et al*, 2002) [11] in facilitating glucose disposal and utilization in peripheral tissues.

This study gives a strong correlation between plasma glucose level and TSH level amongst the type 2 diabetics. Now, Brenta, 2010 [12], Yadav *et al.,* 2012 [13], Swamy *et al.,* 2012 [14], Duntas *et al.*, 2011 [15]-these studies showed the similar type of results.

In hypothyroidism, glucose homeostasis is affected. Decreased glucose disposal (as compared with euthyroid subjects) has been proved in hypothyroid patients. Hypothyroidism results in unimpaired (Muller MJ *et al*, 1983) [16] or decreased (Okajima F *et al*, 1979) [17], (McCulloch AJ *et al*, 1983) [18] liver glucose output thereby compensating for insulin resistance present in peripheral tissues and accounting for the diminished insulin requirement for glycaemic control in hypothyroid diabetic patients.

Conclusion

From this study, we found hypothyroidism is seen among type 2 diabetics. So, screening of all diabetics for thyroid disorders should be included in the routine investigation for the better diagnosis and prognosis of the patients. Diabetes patients with hypothyroidism, who are high risk for cardiovascular events, should be considered seriously for treatment.

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