

ASSESSMENT OF THYROID DYSFUNCTIONS IN PATIENTS WITH TYPE II DIABETES MELLITUS IN CENTRAL INDIAMUKESH SINGH TOMAR¹, VEENA MELWANI^{2*}, ANSHULI TRIVEDI³

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Received: 29 December 2021, Revised and Accepted: 05 February 2022

ABSTRACT

Objective: The objective of the study was to assess the prevalence of thyroid disorders among diabetics in Central India.

Methods: This study was conducted as a cross-sectional comparative study at the department of medicine, tertiary care center in Central India on a total of 100 diabetic patients admitted at the study area during the study period of 1 year. Cases in the study group with diabetes and control group (non-diabetic) were enrolled as per inclusion and exclusion criteria in 1:1 ratio. All the patients in both the groups were subjected to the estimation of thyroid function tests, that is, T3, T4, and TSH levels after overnight fasting.

Results: Mean age of patients in the study group was 55.7±10.1 years whereas that of the control group was 53.9±10.6 years. Overall, thyroid dysfunctions were noted in 31% of cases in the study group and 12% of cases in the control group (p<0.05). The most common thyroid dysfunction was hypothyroidism, particularly subclinical hypothyroidism (19% and 8% in the study group and control group, respectively). Thyroid dysfunctions were associated with increased HbA1c in our study group (p<0.05).

Conclusion: Thyroid dysfunctions are observed in higher proportions of cases with diabetes as compared to non-diabetics. All the parameters of thyroid function tests including T3 and T4 levels as well as TSH levels are found to be altered in higher number of diabetics. Poor glycemic control among diabetics is one of the important determinants of thyroid dysfunction in patients with diabetes.

Keywords: Hypothyroidism, Hyperthyroidism, Thyroid disorders, diabetes, Central India.

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INTRODUCTION

Diabetes mellitus and thyroid disorders, particularly hypothyroidism, are common endocrine disorders observed in clinical practice [1]. Due to rapid increase in the prevalence of diabetes in India, India is described as diabetes capital of the world [2]. Diabetes is a single most endocrine disorder which is known to affect every organ system in body and is known to influence the thyroid functions through some common endocrine pathways [3]. Thyroid disorders among diabetics have been associated with adverse clinical outcomes [4].

Hypothyroidism is the most common thyroid disorder in general population and is estimated to affect one in 10 adults in India [5,6]. However, the prevalence of hypothyroidism has been reported to be much higher in diabetics as compared to general population ranging from 12% to 23% [4]. Studies have shown that deranged blood glucose or uncontrolled hyperglycemia affects serum thyroxine (T4) as well as triiodothyronine (T3) levels affecting thyroid functions and thyroid hormones play an important role in regulation of glucose metabolism [7]. The studies assessing the prevalence of thyroid dysfunctions among diabetics in Indian settings are scarce. The present study was, therefore, conducted to assess the prevalence of thyroid disorders among diabetics in Central India.

METHODS

This study was conducted as a cross-sectional comparative study at the department of medicine, tertiary care center in Central India on a total of 100 diabetic patients admitted at the study area during the study period of 1 year, that is, January 1, 2019–December 31, 2019. All the patients with diagnosed type 2 diabetes admitted at our institute and giving consent for the study were included as the study group whereas

all the patients with previous history of thyroid surgery, thyroid disorders, pregnant women, sepsis, heart failure, on corticosteroids therapy, on antithyroid drugs, and seriously ill patients were excluded from the study. A sex- and age-matched healthy non-diabetic control admitted in ward with other condition and meeting the inclusion and exclusion criteria except for the presence of diabetes were enrolled in 1:1 ratio.

The patients in the study and control group were subjected to detailed history taking including sociodemographic variables, clinical history (including symptoms of diabetes and thyroid dysfunction), duration of treatment, complications, and drug history. All the patients were then subjected to detailed general and systemic examination and findings were documented. Diabetes workup was done for both the groups which included FBS, PPBS, and HbA1c. All the patients in both the groups were subjected to the estimation of thyroid function tests, that is, T3, T4, and TSH levels after overnight fasting. Apart from this, LFT and lipid profile were also assessed.

Normal range of T3, T4, and TSH was:

1. T3 – 0.8–2.1 ngm/ml
2. T4 – 5–13 µgm/dl
3. TSH – 0.4–5.5 µIU/ml.

Thyroid disorders were described as:

1. Euthyroid – A state of normal thyroid function, documented biochemically by normal TSH and T3 and T4 levels
2. Overt hypothyroidism – A form of thyroid dysfunction manifested biochemically by an elevated TSH and decreased T3 and T4 level
3. Subclinical hypothyroidism – A form of hypothyroidism wherein TSH is elevated but the T3 and T4 level is within normal

Table 1: Comparison of baseline variables between the groups

Baseline variables	Study group (n=100)	Control group (n=100)	p
Age (years)	55.7±10.1	53.9±10.6	0.22
Gender			
Male	69	72	0.64
Female	31	28	
Comorbidities			
Hypertension	23	21	0.73
Arthritis	3	4	0.70
None	77	78	0.71
Addiction history			
Smoking	25	26	0.87
Alcohol	2	4	0.41
None	73	73	1
BMI (kg/m ²)	24.9±7.4	23.3±8.9	0.17
Waist circumference (cm)	84.2±15.5	82.6±13.7	0.44
Waist-hip ratio	0.89±0.26	0.85±0.24	0.26
FBS			
<126	32	100	0.001*
>126	68	0	
Mean	179.3±51.87	116.3±28.39	
PPBS			
<140	12	100	0.001*
>140	88	0	
Mean	239.3±89.9	124.56±56.8	
HbA1c			
<6.5	0	100	0.001*
>6.5	100	0	
Mean	8.4±2.5	5.9±1.6	

*Statistically significant. BMI: ???, FBS: ???, PPBS: ???, HbA1c: ???

Table 2: Distribution according to clinical features and complications among diabetics (study group)

???	Frequency (n=100), n (%)
Clinical features	
Polydipsia	18 (18)
Polyphagia	12 (12)
Polyuria	21 (21)
Delayed wound healing	7 (7)
Duration of diabetes (years)	
<5	13 (13)
5-10	32 (32)
10-15	38 (38)
>15	17 (17)
Complications	
Stroke	3 (3)
Retinopathy	15 (15)
Nephropathy	19 (19)
Neuropathy	27 (27)

- Overt hyperthyroidism – A form of thyroid dysfunction manifested biochemically by a decreased TSH and increased T3 and T4 level
- Subclinical hyperthyroidism – A form of hyperthyroidism wherein TSH is decreased but the T3 and T4 level is within normal.

Statistical analysis

Data were compiled using MS Excel and statistical analysis was done using Statistical Package for the Social Sciences for Windows (version 20.0). Categorical variables were expressed as frequency (percentage), whereas continuous variables were expressed as mean and standard deviation. Categorical variables between the groups were compared using Chi-square test whereas continuous variables were compared using independent t-test. In the study group, association of thyroid dysfunctions with diabetes characteristics in the study group was assessed using Chi-square test. $p < 0.05$ was considered statistically significant.

Table 3: Distribution according to thyroid function tests

Baseline variables	Study group (n=100)	Control group (n=100)	p
T3 (ng/ml)			
<0.8	19	5	0.001*
0.8-2.1	76	93	
>2.1	5	2	
Mean	1.2±0.45	1.36±0.6	
T4 (µg/dl)			
<5	20	7	0.001*
5-13	73	90	
>13	7	3	
Mean	7.23±2.7	9.1±2.5	
TSH (µIU/ml)			
<0.4	7	3	0.001*
0.4-5.5	69	88	
>5.5	24	9	
Mean	4.9±2.2	3.1±1.6	

T4: Thyroxine, T3: Triiodothyronine, TSH: Thyroid-stimulating hormone

Table 4: Association of thyroid dysfunctions with duration of diabetes, complications, and glycemic control among diabetics

	Euthyroid (n=69)	Hypothyroid (n=23)	Hyperthyroid (n=8)	p
Duration of diabetes (years)				
<5	11 (15.9)	2 (8.7)	0	0.09
5-10	23 (33.3)	7 (30.4)	2 (25)	
10-15	28 (40.6)	7 (30.4)	3 (37.5)	
>15	7 (10.1)	7 (30.4)	3 (37.5)	
Complications				
Stroke	2 (2.9)	1 (4.3)	0	0.32
Retinopathy	8 (11.6)	5 (21.7)	2 (25)	0.35
Nephropathy	9 (13)	7 (30.4)	3 (37.5)	0.07
Neuropathy	15 (21.7)	9 (39.1)	3 (37.5)	0.21
FBS				
<126	24 (34.8)	6 (26.1)	2 (25)	0.67
>126	45 (65.2)	17 (73.9)	6 (75)	
Mean	167.5±54.2	192.3±48.3	194.4±51.0	
PPBS				
<140	9 (13)	2 (8.7)	1 (12.5)	0.86
>140	60 (87)	21 (91.3)	7 (87.5)	
Mean	209±84.3	254.2±91.2	242.3±89.6	
HbA1c				
6.5-7.5	27 (39.1)	3 (13)	1 (12.5)	0.03*
>7.5	42 (60.9)	20 (87)	7 (87.5)	
Mean	7.8±3.9	8.7±2.1	8.3±2.3	

RESULTS

A total of 100 cases were enrolled in each group, that is, study group (patients with type II diabetes) and control group.

Mean age of patients in the study group was 55.7±10.1 years whereas that of the control group was 53.9±10.6 years. Two groups were comparable with respect to age, gender, comorbidities, and anthropometric variables. However, FBS, PPBS, and HbA1c were significantly higher in the study group as the study group comprised diabetic patients and the control group comprised non-diabetic patients ($p < 0.05$).

Polyuria was the predominant feature observed in 21% of cases in the study group followed by polydipsia (18%). Duration of diabetes was more than 10 years in 55% of cases and the most common diabetic complication observed in patients with diabetes was neuropathy in 27% of cases.

In the present study, we documented that thyroid hormones, that is, T3, T4, as well as TSH were deranged in significantly higher proportions

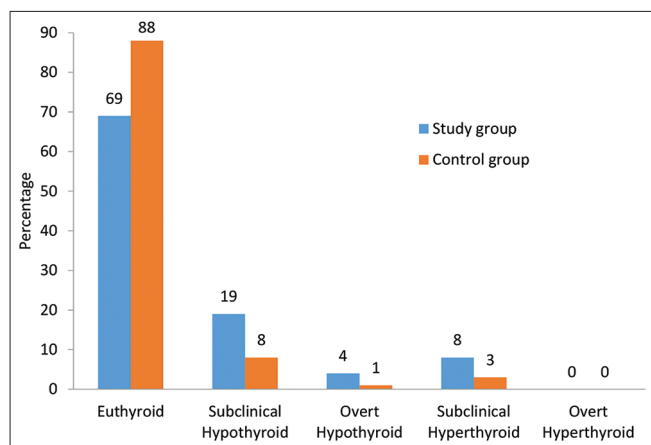


Fig. 1: Thyroid dysfunctions between the groups

of cases in the study group (i.e., diabetic patients) as compared to the control group ($p < 0.05$).

Overall, thyroid dysfunctions were noted in 31% of cases in the study group and 12% of cases in the control group. The most common thyroid dysfunction was hypothyroidism, particularly subclinical hypothyroidism (19% and 8% in the study group and control group, respectively). The prevalence of thyroid dysfunctions was observed in significantly higher proportions of cases in the study group as compared to the control group ($p < 0.05$).

DISCUSSION

India is experiencing a rapid demographic transition due to rapid urbanization and westernization. As the risk factors associated with non-communicable diseases are increasing such as lack of physical activity, unhealthy diet, sedentary lifestyle, tobacco, and alcohol addiction, the prevalence of diabetes is increasing rapidly to such a level that it has been considered as impending pandemic and India is considered as diabetic capital of the world [2]. It is well known that diabetes is associated with microvascular as well as macrovascular complications. Apart from this, diabetes is known to affect every organ and thyroid is no exception [3,4]. Our study aimed to assess the prevalence of thyroid disorders in cases with diabetes and compare it with patients without diabetes. We reported significantly higher prevalence of thyroid disorders in diabetics (31%) as compared to the control group (12%), the most common form of thyroid disorder being subclinical hypothyroidism. Our study findings were concordant with the findings of Yadav *et al.*, in which the prevalence of subclinical hypothyroidism was documented to be higher in type 2 diabetes with estimated prevalence of 14.1% [4]. Our study findings were also supported by the findings of Hussain *et al.*, where the authors reported thyroid dysfunctions in 21% of cases with diabetes, of them majority, that is, 42% had hypothyroidism and 36% had subclinical hypothyroidism [1]. Similar findings were documented by Demitrost *et al.*, in which 31.2% of cases with diabetes had thyroid dysfunctions, of them 16.3% had subclinical hypothyroidism, 11.4% had hypothyroidism, whereas 2% and 1.5% had subclinical and overt hyperthyroidism, respectively [8].

The thyroid hormones, that is, both T3 and T4, have antagonistic action against insulin and potentiate the action of insulin indirectly [9]. However, thyrotropin-releasing hormone release is decreased in diabetes, which could be the fact associated with the low level of thyroid hormones in diabetics [10]. In our study, T3, T4, as well as TSH levels were deranged (particularly revealing hypothyroid picture) in significantly higher proportions of cases with diabetes as compared to the control group. Similarly, Pasupathi *et al.* reported significantly higher T4 and lower TSH in diabetes cases as compared to controls, but the difference in T3

levels between the groups was statistically insignificant ($p > 0.05$) [11]. However, Udiong *et al.* reported significantly higher derangement in T4 levels in diabetes as compared to controls [12].

In our study, though the duration of diabetes did not affect the thyroid profile, we reported significant association of thyroid dysfunction with poor glycemic control as revealed by HbA1c levels. The findings of our study were supported by the findings of Ogbonna *et al.*, in which the risk of thyroid dysfunctions was reported to be 4.3 times higher in cases with elevated HbA1c levels as compared to patients with good glycemic control (HbA1c < 7%) [13]. Similarly, Ardekani *et al.* also reported significantly higher rate of thyroid disorders in diabetics with higher HbA1c levels [14]. However, Bazrafshan *et al.* reported a significant positive correlation between HbA1c and TSH levels [15]. This could be attributed to chronic hyperglycemia-induced adverse effect on the hypothalamopituitary axis, which abolishes the TSH peak [16]. Thyroid dysfunction, particularly hypothyroidism in diabetes, may alter the glucose metabolism along with reduced production of glucose in hepatocytes and present with hypoglycemia [17,18]. In contrast, hyperthyroidism reduces the half-life of insulin contributing to hyperglycemia [19]. Thus, thyroid dysfunctions may alter the glycemic control leading to increased HbA1c levels indicating raised HbA1c levels to correlate with thyroid dysfunction.

CONCLUSION

Thyroid dysfunctions are observed in higher proportions of cases with diabetes as compared to non-diabetes. All the parameters of thyroid function tests including T3 and T4 levels as well as TSH levels are found to be altered in higher number of diabetics. Poor glycemic control among diabetics is one of the important determinants of thyroid dysfunction in patients with diabetes.

AUTHORS' CONTRIBUTIONS

All the authors have contributed to the preparation and editing of this research article.

CONFLICTS OF INTEREST

None.

AUTHORS' FUNDING

None.

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