

Prevalence of thyroid dysfunction in newly diagnosed type 2 diabetes mellitus

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Abstract

Background: Type 2 diabetes mellitus (DM) is a growing problem in our country and various studies have found that diabetes and thyroid disorders mutually influence each other and both disorders tend to coexist. However, the prevalence of thyroid dysfunction in these patients has not been investigated. **Aims and Objectives:** To study the prevalence of thyroid dysfunction in newly diagnosed T2DM. **Materials and Methods:** The study was conducted on 100 newly diagnosed T2DM patients. Investigations including FBS, PPBS, HbA1c, thyroid function test like FT3, FT4, TSH was done for all patients. The correlations of prevalence of thyroid dysfunction with HbA1c and gender distribution were done. The observations and interpretations were recorded and results obtained were statistically analyzed. **Results:** The prevalence of thyroid dysfunction was very high in newly diagnosed T2DM patients. Most prevalent thyroid dysfunction was subclinical hypothyroidism (21%) followed by overt hypothyroidism (7%). The prevalence of thyroid dysfunction was more common in females than males. This study also stated that high HbA1c values (>8) at diagnosis were increased risk of thyroid dysfunction. **Conclusion:** There was a significant association between type 2 diabetes mellitus and thyroid dysfunction. All patients with high HbA1c values on diagnosis should be screened for thyroid dysfunction.

Key Words: Subclinical hypothyroidism, overt hypothyroidism, type 2 diabetes mellitus, thyroid stimulating hormone (TSH) and HbA1c.

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INTRODUCTION

Diabetes mellitus is a syndrome characterized by chronic hyperglycemia and disturbances in carbohydrate, fat and protein metabolism associated with absolute or relative deficiency of insulin secretion and / or insulin action¹. The World Health Organization (WHO) has projected that the global prevalence of diabetes will increase to 300 million (7.8%) by 2030.² In type 2 diabetes mellitus, the prevalence of thyroid disorder is increasing very rapidly.

The association of thyroid dysfunction with type 2 DM is widely known and studies revealing such an association was first published in 1979³. Thyroid disorders directly influence the insulin secretion. In hypothyroidism, there is reduction in glucose induced insulin secretion by beta cells. In hyperthyroid disorders, insulin and catecholamines resistance is increased⁴⁻⁶. The hyperglycemic state in diabetics, influences the thyroid dysfunction at the hypothalamus and also at the peripheries. Hyperglycemia blunts the nocturnal TSH peak and reduces TRH influence on TSH. In liver, it reduces the peripheral conversion of T4 to T3^{7,8}. Many studies have been done to signify the relationship between thyroid function and diabetes mellitus. Our aim in conducting this study is to know the prevalence of thyroid dysfunction in patients with newly diagnosed type 2 diabetes mellitus.

MATERIALS AND METHODS

A cross sectional studies with a sample size of 100 patients were included in our study. Our study was

conducted at Aarupadai Veedu Medical College and Hospital, Puducherry from January 2016 to December 2016. The inclusion criteria includes all adult patients of newly diagnosed type 2 diabetes mellitus according to American diabetic association criteria 2015.⁹ The exclusion criteria are patients with an already diagnosed thyroid disorder, type 1 DM, pregnant females, known T2DM and patients with intake of drugs affecting thyroid function such as amiodarone, lithium etc. A thorough clinical examination including vitals, general physical examination, systemic examination and investigations was carried out. The investigations done include FBS, PPBS, HbA1c, Free T3, Free T4 and TSH. The normal range of thyroid hormone are as follows:

Free T3 = 0.60 – 1.81 ng/ml
 Free T4 = 4.50 – 10.90 µg/dl
 TSH = 0.35 – 5.50 mIU/L.

Subclinical hypothyroidism is defined as an elevated TSH level (5.5-10 mIU/L) with normal serum thyroid hormone levels. Hypothyroidism is defined as an elevated TSH (>10 mIU/L) together with a decreased serum thyroid hormone levels. Subclinical hyperthyroidism is defined as a decreased TSH with normal thyroid hormone levels and hyperthyroidism was defined as a decreased TSH with elevated thyroid hormone levels.

RESULTS

The sample size in our study was 100 newly diagnosed diabetic patients. The male to female ratio was 66:34, who were screened for thyroid disorder (fig.1). Out of the 100 patients, 72 were euthyroid, 21 had subclinical

hypothyroidism and 7 had overt hypothyroidism (fig.2). In the 28 patients who had abnormal thyroid values, 22 were female and 6 were male. We compared the TSH values with HbA1c values of the 28 abnormal patients and found that most of the patients were in the subclinical hypothyroid range (21%), the rest were in overt hypothyroid (7%) range. We also found that raised HbA1c values were associated with increased TSH values. Thereby proving that, increased HbA1c renders a patient more susceptible for subclinical or overt hypothyroidism (Table no.2). There were 3 patients in the 6.5-8 HbA1c range, 18 were in 8-9 HbA1c range and >9 HbA1c range had 7 patients. According to thyroid values, 21% were in the subclinical range and 7% in hypothyroid range. In our study we also found that only 5.5 % of the 28 patients who had abnormal thyroid dysfunction were in the 6.5-8.0 HbA1c range. In patients with HbA1c range of 8-9, 60% thyroid dysfunction and in patients with HbA1c >9 had 46.7% of thyroid dysfunction (Table no.3). The above results prove that as the HbA1c values increase, the risk of developing subclinical or overt hypothyroidism also increase significantly especially in whom HbA1c is above 8.0. Overall, the comparison between euthyroid diabetic patients and thyroid dysfunction diabetic patients, showed an increase in the mean values of HbA1c in thyroid dysfunction patients compared to euthyroid diabetics. The other findings of TSH, FT3, FT4 were also on similar lines with HbA1c proving that increased glycemic value leads to increased risk of developing thyroid dysfunction.

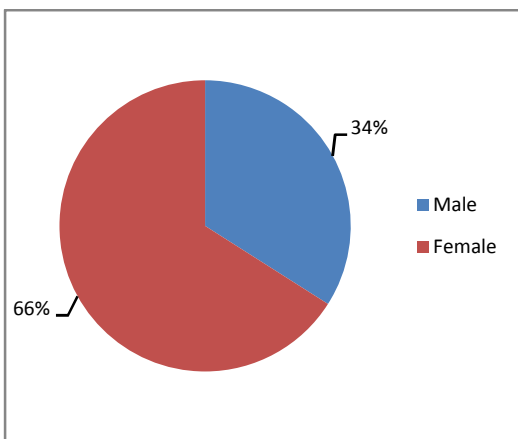


Figure 1

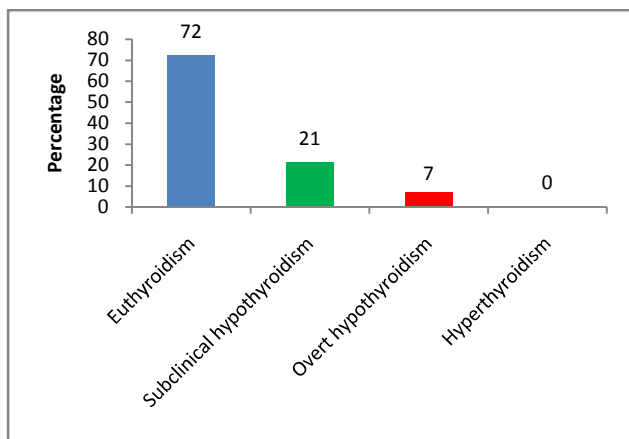


Figure 2

Table 1

Parameters	Overall	Thyroid Disorder
HbA1C	7.687±0.8732	8.703±0.827
TSH	5.27±4.846	11.1664±5.461
FT3	1.079±0.393	0.761±0.295
FT4	7.249±1.784	6.477±1.692
FBS	162.42±22.747	160.785±23.503
PPBS	301.06±29.585	299.642±29.605

Table 2

TSH	HbA1C		
	6.5-8	8-9	>9
5.5-10	3 (100%)	16 (88.8%)	2 (28.6%)
>10	0 (0%)	2 (11.2%)	7 (71.4%)
Total	3 (100%)	18 (100%)	7 (100%)

$\chi^2 = 10.965$ 'P' Value = 0.026, Significant

Table 3

Thyroid Dysfunction	HbA1C		
	6.5-8	8-9	>9
Present	3 (5.5%)	18 (60%)	7 (46.7%)
Absent	52 (94.5%)	12 (40%)	8 (53.3%)
Total	55 (100%)	30 (100%)	15 (100%)

$\chi^2 = 31.697$, 'P' Value = <0.0001, Significant

DISCUSSION

Thyroid diseases and diabetes mellitus are two most common endocrine disorder dealt in common practice. Diabetes mellitus and thyroid disorders have been shown to mutually influence each other and associations between both conditions have long been reported.^{10,11} The half life of insulin is reduced in hyperthyroidism due to increased rate of degradation and an enhanced release of biologically inactive insulin precursors^{12,13}. A reduced rate of liver glucose production is observed in hypothyroidism and accounts for the decrease in insulin requirement in hypothyroid diabetic patients.¹⁴ In diabetic patients, the nocturnal TSH peak is blunted and the effect of TRH on TSH is impaired. Reduced T3 levels have been observed in uncontrolled diabetic patients. The low T3 state is due to reduced peripheral conversion of T4 to T3¹⁵. Higher level of circulating insulin has a proliferative effect on thyroid tissues resulting in increased formation of nodules^{16,17}. In our study, we took 100 newly diagnosed diabetic patients. Out of 100, 72 were euthyroid, 21 had subclinical hypothyroidism and 7 had overt hypothyroidism. Majority of patients were in subclinical hypothyroidism group which suggests that subclinical hypothyroidism is the most prevalent thyroid dysfunction in T2DM. We also compared TSH values with HbA1c values and found that high HbA1c values (>8) had statistically significant increased incidence of thyroid dysfunction. According to Papazafiropoulou *et al*, the prevalence rate of thyroid dysfunction in type 2 diabetes mellitus was 12.3%. In the group with thyroid

dysfunction there was an excess of females in comparison with the group without thyroid dysfunction.¹⁸ One study by Datchinamoorthy showed that thyroid function levels were altered in DM patients, particularly with T3 and TSH levels.¹⁹ Another study by Demitrost showed that in type 2 DM patients, 68.8% are euthyroid, 16.3% have subclinical hypothyroidism, 11.4% have hypothyroidism, 2% have subclinical hyperthyroidism and 1.5% have hyperthyroidism. It also showed that Prevalence of hypothyroidism is quite high in type 2 DM patients who are above 45 years and more so if their BMI is over 25kg/m².²⁰ According to Khurana *et al*, there was a high prevalence (16%) of thyroid disorders in patients of type 2 diabetes mellitus. Most common was subclinical hypothyroidism (7.5%) which was further found to be more in females, elderly patients, and patients with uncontrolled diabetes.²¹

LIMITATION

In our study, follow up of the glycemic status of the patients with thyroid dysfunction was not done. Due to this, our study has not incorporated the correlation between well controlled glycemic status and level of thyroid dysfunction. Our study has also not made any association with BMI and dyslipidemia with thyroid dysfunction. More large scale prospective studies have to be conducted in the future for further evaluation.

CONCLUSION

The prevalence of thyroid dysfunction in patients with newly diagnosed type 2 DM was high. This is in accordance with other studies. In general, female patients with diabetes mellitus were more prone to developing thyroid dysfunction. Based on these results, any patient presenting to an outpatient department with type 2 diabetes mellitus, it is worthwhile performing a thyroid function test to evaluate the thyroid status. This study necessitates a routine screening for thyroid function in all patients with type 2 diabetes mellitus.

REFERENCES

1. Power A C. "Diabetes mellitus: Diagnosis, classification and pathophysiology" *Harrisons principles of internal medicine* 2015; 417(2):2399-07.
2. Maratou E, Hadjudakis D J, Peppas M, et al. Studies of insulin resistance in patients with clinical and subclinical hyperthyroidism. *Eur J Endocrinol* 2010; 163(4): 625-30.
3. Wang C. "The relationship between type 2 diabetes mellitus and related thyroid diseases". *Journal of diabetes research* 2013: 1-9
4. Mitron P, Raptis S A, Dimitriadis G et al. "Insulin action in hyperthyroidism: a focus on muscle and adipose tissue," *Endocrine Reviews* 2010; 3(5):663-79

5. Duntas L H, Orgiazzi J, Brabant G et al. “The interface between thyroid and diabetes mellitus,” *Clinical Endocrinology*, 2011; 75(1): 1–9.
6. Rezzonico J, Niepomniszcze H, Rezzonico M, Pusiol E, Alberto M et al, “The association of insulin resistance with subclinical thyrotoxicosis,” *Thyroid*, 2011; 21(9): 945–49.
7. Vikhe V B, Kanitkar S A, Tamakuwala K K, Gaikwad A N, Kalyan M Agarwal R R et al. “Thyroid dysfunction in patients with type 2 diabetes mellitus at tertiary care center”. *National Journal of medical research* 2013; 3(4):377-80.
8. Chen H S, Wu T E, Jap T S, Lu R A, Wang M L, Chen R L, et al. “Subclinical hypothyroidism is a risk factor for nephropathy and cardiovascular diseases in Type 2 diabetic patients”. *Diabet Med* 2007; 24(12):1336-44.
9. American Diabetes Association. Classification and diagnosis of diabetes. Sec. 2. In *Standards of Medical Care in Diabetes 2015*. *Diabetes Care* 2015;38 : S8–16
10. Feely J and Isles T E, “Screening for thyroid dysfunction in diabetics,” *British Medical Journal*, 1979; 1: 1678.
11. Gray R S, Irvine W, Clarke et al. “Screening for thyroid dysfunction in diabetics,” *British medical journal* 1979; 6202(2):1979.
12. O’Meara N, Blackman J, Sturis J, Polonsky K et al. “Alterations in the kinetics of C-peptide and insulin secretion in hyperthyroidism,” *Journal of Clinical Endocrinology and Metabolism* 1993; 76(1):79–84.
13. Dimitriadis G, Baker B, Marsh H et al., “Effect of thyroid hormone excess on action, secretion, and metabolism of insulin in humans,” *The American journal of physiology* 1985; 248(5): E593–01.
14. Okajima F, Ui M et al. “Metabolism of glucose in hyper- and hypo-thyroid rats in vivo. Glucose-turnover values and futile cycle activities obtained with 14C- and 3H-labelled glucose,” *Biochemical Journal* 1979; 182(2): 565–75.
15. Gursoy N, Tuncel E et al. “The relationship between the glycemic control and the hypothalamus-pituitary-thyroid axis in diabetic patients,” *Turkish Journal of Endocrinology and Metabolism* 1999; 4:163–68.
16. Rezzonico J, Rezzonico M, Pusiol E, Pitoia F et al. “Introducing the thyroid gland as another victim of the insulin resistance syndrome,” *Thyroid* 2008; 18(4): 461–64.
17. Ayturk S, Gursoy A, Kut A, Anil C et al. “Metabolic syndrome and its components are associated with increased thyroid volume and nodule prevalence in mild-to-moderate iodine-deficient area,” *European Journal of Endocrinology* 2009; 161(4): 599–05.
18. Papazafropoulou A, Sotiropoulos A, Kokolaki A et al. Prevalence of thyroid dysfunction among greek type 2 diabetic patients attending an outpatient clinic. *J Clinical Medicine Research* 2010; 2 (2): 75-8.
19. Datchinamoorthi. ”Study of thyroid dysfunction in type 2 diabetes mellitus” *IJPSR*, 2016; Vol. 7(9): 3877-80.
20. Demitrost L, Ranabir S et al. “Thyroid dysfunction in type 2 diabetes mellitus: A retrospective study” *Indian Journal of Endocr Metab* 2012; 16:s334-s335
21. Ashok K, Preeti D, Gourav J.”Prevalence of thyroid disorders in patients with type 2 diabetes mellitus” *JACM* 2016; 17(1): 12-15.

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