

Clinical status of thyroid functions in patients with diabetes mellitus

¹Kamalasanan.C.G *,²Kiran Kamalasanan

¹Additional Professor, Department of Medicine, Government Medical College, Kozhikode, Kerala.

²Trainee in Surgical Oncology, Regional Cancer Centre, Thiruvananthapuram, Kerala.

Correspondence Author: Dr.Kamalasanan.C.G, Additional Professor, Department of Medicine, Government Medical College, Kozhikode, Kerala, India

Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Background: Among the endocrine disorders, diabetes mellitus (DM) and thyroid dysfunction (TD) are frequently encountered during clinical practice. The objective of the present study was to show the prevalence of thyroid dysfunction in type 1 and 2 diabetic patients.

Methods: The study was conducted on 186 diabetic patients who attended the outpatient diabetic clinic of Department of Medicine, Government Medical College, Kozhikode, Kerala, India. The study was prospective descriptive study. The recruited patients underwent routine clinical and laboratory investigation. The prevalence of thyroid abnormality was correlated with gender, age, Glycated hemoglobin, duration of diabetes, hypertension, family history of thyroid disorder and hyperlipidemia.

Results: The overall prevalence rate of thyroid dysfunction was found to be 25%. Among the type of thyroid abnormalities, the commonest was subclinical hypothyroidism (14.4%) and subclinical hyperthyroidism (8.2%) followed by primary hyperthyroidism (2.4%). Male patients were more affected with thyroid disorders as that of the females. Further, the prevalence of thyroid disorder was high in patients with age lower than 50 years and also in the patients with uncontrolled diabetes with Glycated hemoglobin value ≥ 7 .

Conclusions: The prevalence of thyroid disorder was very high in type 2 diabetic patients and the subclinical hypothyroidism was the more common thyroid disorder. Thus, thyroid screening is highly essential for diabetic patients with poor diabetic control.

Keywords: Diabetes mellitus, thyroid disorders, Glycated Haemoglobin.

Introduction

Globally, thyroid disorders and diabetes mellitus are the frequent metabolic disorders seen in clinical set up. Previous studies indicate that diabetes and thyroid disorders mutually influence each other and an association between both conditions has been reported in literature [1]. Thyroid disease is a pathological state that can adversely affect glycemic control in diabetics and has the potential to affect the health. Thyroid disease is found commonly in diabetes and is associated with advanced age, particularly in type 2 diabetes and underlying autoimmune disease in type 1 diabetes [2].

Insulin and thyroid hormones are intimately involved in cellular metabolism and thus excess or deficit of either of these hormones result in the functional derangement of the other. The physiological and biochemical interrelationship between insulin and the influence of both insulin and iodothyronines on the metabolism of carbohydrates, proteins and lipids are recorded. Such records indicate that

iodothyronines are insulin antagonist with high levels being diabetogenic while absence of the hormone inhibits the development of diabetes [3]. The thyroid hormone replacement is associated with a decrease in glycated haemoglobin (HbA1c) level, which is influenced by increased erythropoiesis rather than by changes in glucose level [4].

There is loss of vision in patients of Graves's disease who have superimposed diabetes and insulin resistance increases the nodularity of thyroid gland. Furthermore, it seems that unidentified thyroid dysfunction could negatively impact diabetes and its complications [1].

Excessive thyroid hormones increase the rate of digestive tract absorption and increase insulin resistance and insulin degradation. In hypothyroidism, liver secretion of glycogen decreases, so does degradation, leading to increased levels of glycogen. Absorption of glucose from the gastrointestinal tract is slowed, and glucose utilization is slowed in the peripheral tissues. The availability of gluconeogenic substrate is decreased [2]. Hyperthyroidism impairs glycemic control in diabetic subjects, while hypothyroidism increases susceptibility to hypoglycemia thus complicating diabetes management [1].

There is a continuing interest in the association between thyroid disorders in diabetes mellitus type 2. The present work is a modest attempt to study the occurrence of thyroid disorders in patients with Type 2 DM and to see the correlation between thyroid profile and diabetes mellitus.

Patients and Methods

This is a prospective descriptive study. One hundred eighty six (186) patients which included 95 males and 91 females with a mean age of 54.65 ± 12.709 years with diabetes mellitus that regularly attended the outpatient clinic of Department of Medicine, Government Medical College, Kozhikode, Kerala, India. Written informed consent for the study was obtained from all of the patients

aged 18 years or older or from the parents or guardians of the patients younger than 18 years. The inclusion criteria was patients diagnosed with diabetes mellitus and thyroid disorder, having duration of diabetes mellitus for longer than 6 months and absence of renal, hepatic and bone disease. Thorough clinical history regarding diabetes mellitus (onset, duration), any history of long term illness, any previous thyroid dysfunction, previous history of any kind of drug therapy, whether the patient was on insulin or oral hypoglycemic drugs was sought. A thorough clinical examination including vitals, general physical examination, systemic examination and investigations like FBS, PPBS, HbA1C, T3, T4, FT3, FT4 and TSH was carried out. Data on comorbidities such as hypertension, dyslipidaemia were also taken. Biochemical investigations were carried out using proper aseptic precautions for collecting blood. Patients were examined for presence of diabetes mellitus according to ADA criteria for diagnosis of diabetes mellitus. Prevalence rate of thyroid dysfunction was studied and their statistical significance with various parameters was obtained using chi-square tests.

Guidelines for detection of thyroid dysfunction (6)

- Normal – when T3, T4 and TSH were in normal range
- Primary Hypothyroidism – when TSH more than 5.5mIU/ml and T3, T4 less than normal.
- Primary Hyperthyroidism – when TSH is less than 0.3mIU/ml and T3, T4 more than normal.
- Subclinical Hypothyroidism – when TSH is more than 5.5 mIU/ml and T3, T4 is within normal range.
- Subclinical Hyperthyroidism – when TSH is less than 0.3 mIU/ml and T3, T4 is within normal range.

Normal values:

- FBS: 60-90mg%
- PPBS: 80-150mg%
- HbA1c: 4-5.6%
- TSH: 0.35-4.94IU/ml

- T3: 58-159ng/ml
- T4: 4.7-11.7µg/dl
- FT3: 1.71-3.71pg/dl
- FT4: 0.7-1.48ng/dl

The correlation of prevalence of thyroid disorder with gender distribution, age distribution, HbA1C, duration of diabetes, hypertension, family history of thyroid disorder and dyslipidaemia was then done. The observations and interpretations were recorded and results obtained were statistically analysed by SPSS using chi square test. Results are significant if p value < 0.05 and non-significant if p value > 0.05.

Results

The prevalence of thyroid dysfunction in all diabetic patients was 21.5%, i.e. 40 out of 186 diabetic patients had thyroid dysfunction. The study included 95 males and 91 females with a mean age of 54.65±12.709 years (males having a mean age of 59.89±11.883 and females having a mean age of 49.16±11.185 years). The most common thyroid disorder being the subclinical hypothyroidism (12.4%) followed by subclinical hyperthyroidism (6.5%) which was followed by primary hyperthyroidism (2.7%) and primary hypothyroidism (0%). Out of 95 male patients, 7 (7.4%) had subclinical hypothyroidism, 5 (5.3%) had subclinical hyperthyroidism and none had primary hypothyroidism and primary hyperthyroidism. Out of 91 female patients, 16 (17.6%) had subclinical hypothyroidism, 7 (7.7%) had subclinical hyperthyroidism, 5 (5.5%) had primary hyperthyroidism and none had primary hypothyroidism (Table 1). Prevalence of thyroid disorders was found to be more in males than in females, highest in the age group of <50 years, more in patients with HbA1c values ≥7, i.e. in uncontrolled diabetes. More in patients with HbA1c values ≥7, i.e. in uncontrolled diabetes. The association of prevalence of thyroid disorders with hypertension,

duration of diabetes, hypotension and family history of diabetes was not significant.

Discussion

In this study, 21.5% i.e., 40 out of 186 patients suffering from diabetes mellitus had abnormal thyroid profile and 146 patients (78.5%) were found to be euthyroid. The findings of our study are consistent with studies of Papazafiropoulou A et al, Nobre EL et al, Vikram B Vikhe et al, M. Anita Devi et al, Priti Singh et al and KiranNagaraju et al.²³ (12.4%) and 17 (9.1%) of the total diabetes patients having thyroid disorder had hypothyroidism and hyperthyroidism respectively (8-11). Subclinical hypothyroidism was the most prevalent disorder in diabetic patients in the study occurring in 12.4% followed by subclinical hyperthyroidism in 6.5%, primary hyperthyroidism in 2.7% and primary hypothyroidism in none of the total 186 diabetic patients. Thus among thyroid dysfunction maximum prevalence was found to be of subclinical hypothyroidism whereas primary hypothyroidism was least found (12)

Prevalence of thyroid dysfunction according to gender

In the present study, the prevalence of thyroid disorders in diabetic patients was more in males as compared to females (72.5% vs 27.5%) which when evaluated statistically was significant (p=0.002). Our results are consistent with the study of Shabaze in Hajieh et al which reported prevalence of thyroid disorder higher in diabetic males as compared to diabetic females (13). Thus the prevalence of thyroid disorder in diabetic patients is strongly influenced by gender.

Prevalence of thyroid dysfunction according to age group

Out of the 40 diabetic patients who had thyroid disorder, 19 (47.5%) belong to the age group of <50 years, 7 (17.5%) belong to the age group of 50-60 years and 14 (35%) belonged to the age group of >60 years. Thus the age specific trend in the prevalence of thyroid disorder

was found to be highest in the age group of <50 years. This when evaluated statistically was significant ($p=0.030$) (Table 2). The results of our study are in accordance with the previous study of PenugondaAnveetha et al who also found high prevalence of thyroid disorder in diabetic patients with advancing age (15). Thus with increasing age the prevalence of thyroid disorder in type 2 diabetes showed an increasing trend.

Prevalence of thyroid dysfunction according to HbA1c values

In the study out of 40 diabetic patients who had thyroid disorder, 17 (48.6%) had $HbA1c < 7$ and 18 (51.4%) had $HbA1c \geq 7$. The prevalence of thyroid disorder was found to be more in patients with $HbA1c \geq 7$ as compared to patients with $HbA1c < 7$. This difference was statistically significant ($p=0.004$). Our results are comparable with the previously conducted studies of Tajinder Singh et al and Jain G et al. Thus prevalence of thyroid disorder was more in patients with $HbA1c \geq 7$ i.e. in patients having poorly controlled diabetes.

Prevalence of thyroid dysfunction according to duration of diabetes

Out of the 40 diabetic patients with thyroid disorder, 5(12.5%) had duration of diabetes ≤ 1 yr, 18 (45%) had a duration of diabetes for 1-5 yrs and 17 (42.5%) had duration of diabetes for 6-10 yrs. However this difference when evaluated statistically was not significant ($p=0.656$). Thus we found that prevalence of thyroid disorder was not significantly affected with duration of diabetes. Our results are in concordance with Athanasia et al (2010) who found out that no significant relationship is present between thyroid dysfunction and duration of diabetes.

Prevalence of co-morbid conditions in patients with thyroid dysfunction

In the study, out of 40 diabetic patients who had thyroid disorder, 30 (75%) were normotensive and 10 (25%) had hypertension. Although the prevalence of thyroid disorder

was found to be more in patients who had hypertension, this difference observed was not significant statistically ($p=0.267$). Our results are in concordance with Roos A et al who also found that there was no significant association of hypertension and presence of thyroid dysfunction in diabetic patients.

Out of the 40 diabetic patients who had thyroid disorders, 2 (5.0%) had ischemic heart disease and 38 (95.0%) had no ischemic heart disease. The prevalence of thyroid disease was found to be in no relation with occurrence of ischemic heart disease and was statistically not significant ($p=0.782$).

The occurrence of hypotension ($p=0.158$) and osmotic symptoms ($p=0.192$) were not found in 40 diabetic patients who had thyroid disorders and thus the presence of both had shown no significance with thyroid disorder.

Prevalence of thyroid dysfunction according to family history

In this study, out of 40 diabetic patients who had thyroid disorder, 11 (27.5%) had a family history of thyroid disorder and 29 (72.5%) had no family history of thyroid disorders. In this study the prevalence of thyroid disorder was found to be more in patients who had no family history of thyroid disorder. However this difference observed was not significant statistically ($p=0.746$). To conclude there is a high prevalence of thyroid disorders in patients with diabetes mellitus which was further found to be more in males, in age group <50 years and in patients with uncontrolled diabetes, i.e. $HbA1c \geq 7$. So regular screening of thyroid function in all type 2 diabetic patients should be done especially with uncontrolled diabetes.

Conclusion

This study shows a prevalence of 21.5% of abnormal thyroid hormone level among diabetic subjects. [15]The relationship between thyroid disorders and diabetes mellitus is characterized by a complex interdependent interaction. Failure to recognize the presence of abnormal

thyroid hormone level in diabetes may be a primary cause of poor management often encountered in some diabetics on treatment. Therefore screening for thyroid disease among patients with diabetes should be routinely performed for better control of both and to avoid possible aggravation of classical risk factors such as hypertension and dyslipidemia, which can lead to cardiovascular risk in these patients.

References

1. Hage M, Zantout MS, Azar ST. Thyroid disorders and diabetes mellitus. *J Thyroid Res.* 2011;2011:439463.
2. Johnson JL. Diabetes control in thyroid disease. *Diabetes Spectr.*2006;19:148–53.
3. Granner DK. Thyroid hormones. In: Murray RK, Granner DK, Mayes PA, Rodwell VW, editors. *Harper’s Biochemistry.* 25th ed. London: Prentice-Hall International Inc.; 2000. p. 533–8.
4. Kim MK, Kwon HS, Baek K, Lee JH, Park WC, Sohn HS, et al. Effects of thyroid hormone on A1C and glycated albumin levels in non-diabetic subjects with overt hypothyroidism. *Diabetes Care.* 2010; 33:2546–8.
5. Jain G, Marwaha TS, Khurana A, Dhoat PS. Prevalence of Thyroid disorders in Patients of type 2 Diabetes Mellitus. *IJMDS.* 2013;2(2):154-5.
6. Vinu V, Chitnis P, Gupta VK. Evaluation of thyroid dysfunction among type 2 diabetic patients. *International Journal of pharmacy and biological sciences.* 2012;2(4):151.
7. Taksali R, Bindu SM, Mulay S. Evaluation of Thyroid Dysfunction in Type II Diabetes Mellitus: A Case Control Study. *International Journal of Current Medical And Applied Sciences.* 2013;1(1):17.
8. Papazafiropoulou A, Sotiropoulos A, Kokolaki A, Kardaraa M, Stamatakia P, Pappas S. Prevalence of Thyroid Dysfunction Among Greek Type 2 Diabetic Patients Attending an Outpatient Clinic. *J Clin Med Res.* 2010;2(2):75-8.

9. Nobre EL, Z Jorge, S Pratas, C Silva, JJ Castro. Profile of the thyroid function in a population with type 2 diabetes mellitus. *Endocrine Abstracts.* 2002;3:P298.
10. Devi MA, Singh NS, Singh LS. Thyroid hormone dysfunctions in type 2 diabetic patients in urban areas of Manipur. *International Journal of Pharmaceutical Science Invention.* 2013;2(10):7-9.
11. Singh P, Khan S, Mittal RK. Evolution of thyroid dysfunction among type-2 diabetic mid and far western Nepalese population. *Journal of coastal life medicine.* 2014;2(11):903-6.
12. Nagaraju K, Pirouz A, Sadeghi T, Esmaili P. Prevalence of thyroid dysfunction and its management in diabetic patients attending outpatient clinic of KIMS hospital. *International research journal of pharmacy.* 2013;4(9):132-4.
13. Hajieh S, Behbahani M, Mohtashami AZ. Prevalence of thyroid dysfunction and thyroid auto antibodies in type 2 diabetic patients. *Pak J Med Sci.* 2011;27(5):1169-72.
14. Anveetha P, Rao KP, Chittimoju VK. Study of thyroid profile in patients with type 2 diabetes mellitus. *International journal of pharmacy and biological sciences.* 2015;5(1):24-30.
15. Bharat, Hijam D, Gangte D, Lalnunpui, Premchand, Devi I, Singh GW. Thyroid status in diabetes mellitus: Glycomics and lipidomics. 2013;3(1):106-110.

Table 1: Gender and age distribution of patients in the study

Group	Gender	Number	Mean age in years
186 diabetic patients	Male	95	59.89±11.883
	Female	91	49.16± 11.185

Table 2: Prevalence of Thyroid disease based on HbA1c

Group	HbA1c <7	HbA1c >7	P-value
40 diabetic patients with thyroid disorder	17 (48.6%)	18(51.4%)	0.004*

Table 3:Type of thyroid dysfunctions according to gender.

Gender	Subclinical hypothyroidism	Primary hypothyroidism	Subclinical hyperthyroidism	Primary hyperthyroidism
Male (n=95)	7 (7.4%)	0 (0%)	5 (5.3%)	0 (0%)
Female (n=91)	16 (17.65%)	0 (0%)	7 (7.7%)	5 (5.5%)