

## Prevalence of Thyroid disorders in Patients of type 2 Diabetes Mellitus

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### ABSTRACT

**Background:** Diabetes has become a major health challenge worldwide. Various studies have found that diabetes and thyroid disorders mutually influence each other and both disorders tend to coexist.

**Objective:** To find out the prevalence of thyroid disorders in patients of type 2 diabetes mellitus.

**Material and methods:** The study was conducted on 200 patients of type 2 diabetes mellitus aged between 40-70 years. All the patients were evaluated for thyroid dysfunction by testing thyroid profile (T<sub>3</sub>, T<sub>4</sub> & TSH). The correlation of prevalence of thyroid disorder with gender distribution, age distribution, HbA<sub>1c</sub>, duration of diabetes, hypertension, family history of thyroid disorder, BMI, usage of OHA's and insulin and dyslipidemia was then done. The observations and interpretations were recorded and results obtained were statistically analyzed.

**Results:** 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, patients with uncontrolled diabetes i.e. HbA<sub>1c</sub> values  $\geq 7$  or patients on insulin and patients with BMI  $>30$ .

**Conclusions:** Screening of thyroid dysfunction should be done in all diabetic patients especially in patients with poor diabetic control.

**Key Words:** Type 2 diabetes mellitus, thyroid disorders

### Introduction

Diabetes mellitus is one of the modern pandemics and an important health problem worldwide. [1] Thyroid diseases and diabetes mellitus are the two most common endocrine disorders encountered in clinical practice which have been shown to mutually influence each other and association between both conditions have long been reported. Diabetes mellitus comprises a group of common metabolic disorders that share the phenotype of hyperglycemia. Depending upon the etiology, factors contributing to

hyperglycemia may include reduced insulin secretion, impaired insulin action, decreased glucose utilization and increased glucose production. [2] The influence of other endocrine and non-endocrine organs other than pancreas on diabetes mellitus has been documented. [3] Occasionally, other endocrine disorders such as abnormal thyroid hormone levels are found in diabetes mellitus. [4] Thyroid hormones contribute to the regulation of carbohydrate metabolism and pancreatic function and on the other hand, diabetes also affects thyroid

function tests to a variable extent. Clinical relevance of thyroid diseases, especially in diabetic patients, significantly increases if it is associated with deteriorated function, which can cause a number of problems with metabolic compensation of diabetes. Most serious consequences are increased frequency of hypoglycemia in hypothyroidism and development of potentially life threatening ketoacidosis in thyrotoxicosis. In spite of that, little attention is paid to the diagnosis of thyroid disease in diabetics, as they are diagnosed in only about half of the patients.<sup>[5]</sup> Underlying thyroid disorders may also go undiagnosed because the common signs and symptoms of thyroid disorders are similar to those for diabetes and can be overlooked or attributed to other medical disorders. The recognition of this interdependent relationship between thyroid disease and diabetes is of importance to guide clinicians on the optimal management of both these conditions. The present study was conducted to find out the prevalence of thyroid disorders in patients of type 2 diabetes mellitus.

### Material and methods

The study was conducted on 200 patients of type 2 diabetes mellitus aged between 40-70 years. Patients of type 1 diabetes mellitus, diabetic nephropathy, known history of thyroid dysfunction, on drugs affecting thyroid function and acutely ill critical patients were excluded from the study.

**Procedure** 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 was carried out. 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. All diabetic patients were then subjected to estimation of BMI, HbA<sub>1c</sub>, Serum cholesterol, Serum triglyceride, HDL, VLDL and LDL levels.

All evaluations were done in laboratory of Biochemistry, Department of Sri Guru Ram Das Institute of Medical Sciences and Research, Sri Amritsar. FBS and RBS estimation was done by GOD-POD (Glucose oxidase – Peroxidase) method. HbA<sub>1c</sub> levels were estimated by using NycoCard Reader (Axis Shield) method. BMI was calculated using Quetlet's Index:  $BMI = \text{Weight} / (\text{height in metres})^2$  Serum cholesterol estimation was done by CHOD-PAP (Cholesterol Oxidase- Peroxidase) method. Serum triglyceride estimation was done by GPO-PAP (Glycerol Phosphate Oxidase) method. HDL estimation was done by PEG (Polyethylene glycol) precipitation method. VLDL and LDL levels were calculated as following:-

$$VLDL = TG/5$$

$$LDL = \text{Total Cholesterol} - \text{HDL} - \text{VLDL}$$

Then all the patients were evaluated for thyroid dysfunction by testing thyroid profile (T<sub>3</sub>, T<sub>4</sub> & TSH). Thyroid hormone levels were measured in the by Enhanced Chemiluminescence Labelled Antibody Immunoassay (Amerlite-MABTM) using Vitros-ecl machine.

Normal values:

T<sub>3</sub> = 0.60 – 1.81 ng/ml

T<sub>4</sub> = 4.50 – 10.90 µg/dl

TSH = 0.35 – 5.50 mIU/L

Subclinical hypothyroidism was defined as an elevated TSH level with normal serum thyroid hormone levels. Hypothyroidism was defined as an elevated TSH together with a decreased serum thyroid hormone levels. Subclinical hyperthyroidism was defined as a decreased TSH with normal thyroid hormone levels and hyperthyroidism was defined as decreased TSH with elevated thyroid hormone levels.

The correlation of prevalence of thyroid disorder with gender distribution, age distribution, HbA<sub>1c</sub>, duration of diabetes, hypertension, family history of thyroid disorder, BMI, usage of OHA's and insulin and dyslipidemia was then done. The

observations and interpretations were recorded and results obtained were statistically analyzed using chi square test. Results are significant if p value <0.05 and non significant if p value >0.05.

### Results

Thyroid disorders were found in 16% (32/200) of the diabetic patients. Most common thyroid disorder found was subclinical hypothyroidism (7.5%) followed by hypothyroidism (4.5%) which was followed by hyperthyroidism (2.5%) and subclinical hyperthyroidism (1.5%). Prevalence of thyroid disorders was found to be more in females, highest in the age group of >60 years, more in patients with HbA<sub>1c</sub> values ≥7 i.e. in uncontrolled diabetes, (Table 1) more in patients who had BMI >30, more in patients who were on both oral hypoglycemic agents and insulin. The association of prevalence of thyroid disorders with hypertension, duration of diabetes, family history of thyroid disorder and dyslipidemia was not significant. (Table 2, 3)

**Table 1: Correlation of thyroid disorder with gender, age, HbA1C levels in Type 2 Diabetic Patients**

| Thyroid disorder | FEMALE (n=110) | MALE (n=90) | p value | AGE IN YEARS |            |            | p value | HbA <sub>1c</sub> |            | P value   |
|------------------|----------------|-------------|---------|--------------|------------|------------|---------|-------------------|------------|-----------|
|                  |                |             |         | <50(n=53)    | <50(n=53)  | >60(n=67)  |         | <7(n=99)          | ≥7(n=101)  |           |
| Present(n=32)    | 23(71.87%)     | 9(28.12%)   | 0.03*   | 6(18.75%)    | 8(25%)     | 18(56.25%) | 0.01*   | 6(18.75%)         | 26(81.25%) | <0.001*** |
| Absent(n=168)    | 87(51.78%)     | 81(48.21%)  |         | 47(27.97%)   | 72(42.85%) | 49(29.16%) |         | 93(55.35%)        | 75(44.64%) |           |

**Table 2: Correlation of prevalence of thyroid disorders in type 2 diabetic patients with duration of diabetes, HTN and Family History**

|                              | Duration of DM<br>≤1Yr(n=34) | Duration of DM<br>>1-5(n=73) | Duration of DM<br>6-10(n=82) | Duration of DM<br>>10(n=11) | p value | HTN<br>Absent | HTN<br>Present | p value | FH<br>Absent | FH<br>Present | p value |
|------------------------------|------------------------------|------------------------------|------------------------------|-----------------------------|---------|---------------|----------------|---------|--------------|---------------|---------|
| Thyroid disorder +nt (n=32)  | 4(12.5%)                     | 11(34.37%)                   | 13(40.62%)                   | 4(12.5%)                    | 0.27    | 11(34.37%)    | 21(65.62%)     | 0.34    | 25(78.12%)   | 7(21.87%)     | 0.27    |
| Thyroid disorder -nt (n=168) | 30(17.85%)                   | 62(36.90%)                   | 69(41.07%)                   | 7(4.16%)                    |         | 73(43.45%)    | 95(56.54%)     |         | 144(85.71%)  | 24(14.28%)    |         |

\*Significant \*\* Highly Significant \*\*\* Very Highly Significant  
FH- Family History, HTN- Hypertension

**Table 3: Correlation of prevalence of thyroid disorders in type 2 diabetic patients with BMI, Treatment and and Dyslipidemia**

|                              | BMI <25(n=32) | BMI 25-30(n=76) | BMI >30(n=92) | P value | Oral (n=142) | Oral & Insulin (n=58) | p value   | Dyslipidemia Absent | Dyslipidemia Present | p value |
|------------------------------|---------------|-----------------|---------------|---------|--------------|-----------------------|-----------|---------------------|----------------------|---------|
| Thyroid disorder +nt (n=32)  | 7(21.87%)     | 6(18.75%)       | 19(59.37%)    | 0.04*   | 13(40.62%)   | 19(59.37%)            | <0.001*** | 9(28.12%)           | 23(71.87%)           | 0.48    |
| Thyroid disorder -nt (n=168) | 25(14.88%)    | 70(41.66%)      | 73(43.45%)    |         | 129(76.78%)  | 39(23.21%)            |           | 58(34.52%)          | 110(65.47%)          |         |

\*Significant \*\* Highly Significant \*\*\* Very Highly Significant

## Discussion

In the present study, out of the 200 diabetic patients, 32 (16%) patients had thyroid dysfunction and 168 (84%) patients were found to be euthyroid. The findings of our study are consistent with studies of Papazafiropoulou A et al<sup>[6]</sup> (overall prevalence of thyroid disorder was 12.3%), Nobre EL et al<sup>[7]</sup> (overall prevalence of thyroid disorder was 12.7%) and Radaiedeh AR et al<sup>[8]</sup> (overall prevalence of thyroid disorder was 12.5%). Subclinical hypothyroidism was the most prevalent disorder in diabetic patients in our study, occurring in 7.5% followed by hypothyroidism in 4.5%, hyperthyroidism in 2.5% and subclinical hyperthyroidism in 1.5% of total 200 diabetic patients. Thus among thyroid dysfunction maximum prevalence was found to be of subclinical hypothyroidism whereas subclinical hyperthyroidism was least found. Our results are in concordance with results of Perros P et al,<sup>[9]</sup> Celani MF et al,<sup>[10]</sup> Nobre EL et al,<sup>[7]</sup> Chubb SA et al,<sup>[11]</sup> Babu K et al<sup>[12]</sup> and Radaiedeh AR et al.<sup>[13]</sup>

In the present study the prevalence of thyroid disorders was more in females as compared to males (71.87% vs 28.12%) which when evaluated statistically was significant (Table 1). Our results are consistent with studies of Papazafiropoulou A et al,<sup>[6]</sup> Celani MF,<sup>[10]</sup> Vondra K et al,<sup>[14]</sup> Pimenta WP et al,<sup>[15]</sup> Babu K et al<sup>[12]</sup> and Michalek AM et al<sup>[16]</sup> in which they also reported prevalence of thyroid disorder higher in diabetic females as compared to diabetic males. Thus

prevalence of thyroid disorder in diabetic patients is strongly influenced by female gender.

Out of 32 diabetic patients who had thyroid disorder, 6 (18.75%) patients belonged to age group of <50 years, 8 (25%) patients belonged to age group of 50-60 years and 18 (56.25%) patients belonged to age group >60 years. Thus the age specific trend in the prevalence of thyroid disorder was found to be highest in the age group of >60 years. This when evaluated statistically was significant. (Table 1) The results of our study are in accordance with the previous studies of Michalek AM et al,<sup>[16]</sup> Whitehead C et al,<sup>[17]</sup> Feely J et al,<sup>[18]</sup> Vondra K et al,<sup>[14]</sup> Moulik PK et al<sup>[19]</sup> and Johnson JL et al<sup>[20]</sup> who also found high prevalence of thyroid disorder in diabetic patients with advancing age. Thus with increasing age the prevalence of thyroid disorder in type 2 diabetes showed an increasing trend.

In our study out of 32 diabetic patients who had thyroid disorder, 6 (18.75%) had HbA<sub>1c</sub> <7 and 26 (81.25%) had HbA<sub>1c</sub> ≥7. The prevalence of thyroid disorder was found to be more in patients with HbA<sub>1c</sub> ≥7 as compared to patients with HbA<sub>1c</sub> <7. This difference was highly significant statistically (Table 1). Our results are comparable with the previously conducted studies where Schlienger JL et al<sup>[21]</sup> observed that patients with poorly controlled diabetes i.e. HbA<sub>1c</sub> ≥12 were having low T<sub>3</sub> levels, Bazrafshan HR et al<sup>[22]</sup> found significant positive correlation between HbA<sub>1c</sub> and TSH levels, (Table 1) Ardekani MA et al

<sup>[23]</sup> found HbA<sub>1c</sub> significantly higher in diabetic patients having thyroid disorder as compared to euthyroid patients. (8.9±1.99 vs 7.1±1.02) Thus prevalence of thyroid disorder was more in patients with HbA<sub>1c</sub> ≥7 i.e. in patients having poorly controlled diabetes.

Out of 32 diabetic patients who had thyroid disorder, 4 (12.5%) had duration of diabetes ≤1 yr, 11(34.37%) had duration of diabetes >1-5 years, 13(40.62%) had duration of diabetes 6-10 years and 4 (12.5%) had duration of diabetes >10 years. However this difference when evaluated statistically was not significant. (Table 2) Thus we found that prevalence of thyroid disorder was not significantly affected with duration of diabetes. Our results are in concordance with Diez JJ et al <sup>[24]</sup> who also found no significant relationship between presence of thyroid dysfunction and duration of diabetes.

In our study out of 32 diabetic patients who had thyroid disorder, 11 (34.37%) were normotensive, 21 (65.52%) 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. (Table 2) Our results are in concordance with Roos A et al <sup>[25]</sup> who also found that there was no significant association of hypertension and presence of thyroid dysfunction in diabetic patients.

In our study out of 32 diabetic patients who had thyroid disorder, 25 (78.12%) had no family history of thyroid disorder and 7(21.87%) had

family history of thyroid disorder. 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. (Table 2) Pimenta WP et al <sup>[15]</sup> and Schroner Z et al <sup>[26]</sup> found higher frequency of thyroid disorder with family history of thyroid disorder. The difference observed in our study and above mentioned studies could be due to the reason that in these studies both types of diabetes mellitus (type 1 and 2) were studied but in our study only patients with type 2 diabetes mellitus were included.

In our study out of 32 diabetic patients who had thyroid disorder, 7 (21.87%) had BMI <25, 6 (18.75%) had BMI between 25-30 and 19 (59.37%) had BMI >30. Thus the prevalence of thyroid disorder was found to be more in patients who had BMI >30. This data when evaluated statistically was significant. (Table 3) The findings of our study are similar to the studies by Papazafiropoulou A et al <sup>[6]</sup> and Procs S et al <sup>[27]</sup> who also found prevalence of thyroid disorder to be significantly more in patients who had higher BMI.

In our study out of 32 diabetic patients who had thyroid disorder, 13 (40.62%) were on oral hypoglycemic agents and 19 (59.37%) were on both oral hypoglycemic agents and insulin. The prevalence of thyroid disorder was found to be more in patients who were on both oral hypoglycemic agents and insulin. This difference was found to be highly significant statistically. (Table 3)

Our results are in concordance with Celani MF et al <sup>[10]</sup> who also found prevalence of thyroid disorder significantly more in patients who were on insulin therapy.

In our study out of 32 diabetic patients who had thyroid disorder, 23 (71.87%) had dyslipidemia and 9 (28.12%) had no dyslipidemia. The prevalence of thyroid disorder was found to be more in patients who had dyslipidemia as compared to patients in which dyslipidemia was not present. However, this difference was statistically insignificant. (Table 3) Our results are in concordance with Nobre EL et al <sup>[7]</sup> who also found no significant difference between lipid profile of euthyroid patients and patients having thyroid disorders in type 2 diabetes mellitus. Our results are contrary to results of Papazafiropoulou A et al <sup>[6]</sup> and Regmi A et al <sup>[28]</sup> who found significant correlation between prevalence of thyroid disorder in diabetic patients and dyslipidemia. The difference observed in our study and above mentioned studies could be due to the geographical variations as in these studies Greek and Nepal populations were studied respectively where as our study was confined to Punjab state of India. Ardekani MA et al <sup>[23]</sup> also found significant correlation between dyslipidemia and thyroid disorder. However this difference observed can be due to difference in sample size of both studies (1200 vs 200 patients in our study).

To conclude there is a high prevalence of thyroid disorders in

patients of type 2 diabetes mellitus which was further found to be more in females, elderly patients, patients with uncontrolled diabetes i.e. HbA<sub>1c</sub> values  $\geq 7$  or patients on insulin and patients with BMI  $>30$ . So regular screening of thyroid function in all type 2 diabetic patients should be done especially with uncontrolled diabetes.

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