

Thyroid dysfunction in type-2 diabetes mellitus

Mohd Vaseem Akram^{1*}, Ashish Mittal², Kaushal Kishore³

^{1,2}PG Student, ³Professor and HOD, Department of General Medicine, Santosh Medical College and Hospital, Ghaziabad, Uttar Pradesh, INDIA.

Email: vaseem_akram@rediffmail.com

Abstract

Type- 2 Diabetes Mellitus is a growing metabolic disorder worldwide. Approx 20% population in South Asian region suffer from type-2 Diabetes Mellitus and India is said to be the diabetic capital of world. Thyroid disorder is the commonest endocrine disorder, yet not much is known about the impact or association of type-2 Diabetes Mellitus on Thyroid dysfunction. The present study was done to find out the frequency and type of Thyroid dysfunction among type-2 Diabetes Mellitus patients. **Study design:** A population based prospective study was done over 1^{1/2} years at Santosh Hospital, Ghaziabad. 1000 patients of both gender of type-2 Diabetes Mellitus were included in the study after getting formal consent and ethical clearance. **Inclusion Criteria:** Patients having FPG ≥ 7 nmol/l (≥ 126 mg / dl), PPBG ≥ 11.1 nmol/l (≥ 200 mg / dl), Random BG ≥ 11.1 nmol/l (≥ 200 mg / dl) **Exclusion Criteria:** Patients with type-2 Diabetes Mellitus, Gestational DM, steroid induced DM, and DM with complication were not included in the study. **Result:** Out of 1000 patients of type-2 Diabetes Mellitus, 333 patients had abnormal Thyroid profile, overall prevalence of thyroid dysfunction was 33.3% with subclinical hypothyroidism 11.1%, Hypothyroidism 14.4%, Hyperthyroidism 2.9% and subclinical Hyperthyroidism 4.9%. In the age group 60-69 years, prevalence of dysfunction was 10.6%. Maximum number of hypothyroid cases (n – 86) were seen in patients with blood sugar 200- 249 mg/ dl. **Conclusion:** The prevalence of Thyroid dysfunction in type-2 Diabetes Mellitus was substantially higher (33.3%) in the present study. In view of the high prevalence of Thyroid dysfunction in type-2 Diabetes Mellitus, we recommend screening of all patients with type-2 Diabetes Mellitus for Thyroid dysfunction.

Keyword: Type-2 Diabetes Mellitus, Thyroid dysfunction.

*Address for Correspondence:

Dr. Mohd Vaseem Akram, Post Graduate Student, L-113, Sector- 12, Pratap vihar, Ghaziabad-201009, Uttar Pradesh, INDIA.

Email: vaseem_akram@rediffmail.com

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INTRODUCTION

Diabetes Mellitus is a clinical syndrome characterized by hyperglycemia due to absolute or relative deficiency of Insulin¹. It is defined as fasting blood sugar ≥ 126 mg / dl or post prandial blood sugar ≥ 200 mg / dl or either of two. Diabetes is an iceberg disease. Although increase in both the prevalence and incidence of type-2 diabetes have occurred globally, currently the number of cases of diabetes worldwide is estimated to be around 150 million. This number is predicted to double by 2025 (a prevalence rate of about 5.4 %), with the greatest number of cases being expected in china and India² Diabetes type-2 has

recently escalated in all age groups and is now being seen in younger age groups, including adolescent especially in high risk population. It is estimated that 20% of the current global diabetic population resides in the South East Asia region. The number of diabetic persons in the countries of the region is likely to triple by the year 2025 increasing from the present estimates of about 60 million to 90 million.³ South East Asia countries will become the most challenged region in the world. An Analysis of age specific prevalence rates of Diabetes Mellitus consistently showed an increase in prevalence with increasing age.⁽⁴⁾ In this region, the proportion of people in the age group 30 years and above increased from 37.2% in 1995 to 41.9 % in 2005. There will be a corresponding increase in the proportion of Diabetes in older age groups.

Prevalence in India

The population in India has an increased susceptibility to Diabetes Mellitus. This propensity was demonstrated by multiple survey of migrant Indian residing in Fiji, Singapore, South Africa, UK and USA. The rates of Diabetes in migrants from the Indian subcontinent have consistently shown to exceed those of the local population. The result of prevalence studies of Diabetes Mellitus in India were systematically reviewed with

emphasis on those utilizing the standard WHO criteria for Diabetes diagnosis, The prevalence of disease in adult was found to be 2- 4% in rural and 4- 11.6% in urban dwellers. High frequencies of impaired glucose tolerance, shown by those studies, ranging from 3.6-9.1%.⁵ According to the study in 2000 India had 32 million Diabetic population approximately which rose to 40.9 million in 2006.⁶ The projected figure for 2025 and 2030 are 69.9 million and 80 million respectively.

Prevalence of thyroid disease among diabetes

Thyroid dysfunction are the most common among all the endocrine disease in India. In studies from Western as many as 50% of people in the community have microscopic nodules, 3.5% have occult papillary carcinoma, 15% have palpable goiter, 10% demonstrate an abnormal thyroid stimulating hormones level and 5% of women have overt hypothyroidism.⁷

Endemic goiter and related problems of human health and development caused by nutritional iodine deficiency. On the basis of total burden of significant thyroid disease in the country in the post salt iodization phase is approximately 42 million. The association between Diabetes and thyroid dysfunctions were first published in 1979, they reported prevalence of thyroid dysfunction in diabetes varies from 2.2 % to 17%.⁸ Another study reported high prevalence of abnormal TSH concentration in 31% patients with type-2 diabetes. Diabetes Mellitus appear to influence thyroid function in two sites, firstly at the level of hypothalamic control of TSH release and secondly at peripheral tissue by converting T₄ to T₃.⁹ Hyperglycemia causes reduction in hepatic concentration of T₄₋₅ deiodinase, low serum concentration of T₃ and low, normal, or high level of T₄. Thyroid hormones regulate metabolism and diabetes can alter metabolism.¹⁰

Effect of Diabetes Mellitus on thyroid hormones and thyroid disease

Altered thyroid hormones have described in patients with diabetes especially those with poor glycemic control. In diabetic patients, the nocturnal TSH peak is blunted or abolished, and the TSH response to TRH is impaired.¹¹ Reduced T₃ levels have been observed in uncontrolled diabetic patients. This "low T₃ state" could be explained by an impairment in peripheral in glycemic control. Higher level of circulating insulin associated with insulin resistance have shown a proliferative effect on thyroid tissue resulting in large thyroid size with increased formation of nodules. A higher prevalence of type- I diabetes is observed in patients with Graves orbitopathy than in normal population. The vasculopathic changes associated with diabetes render the optic nerve more susceptible to the pressure exerted by the enlarged extraocular muscles. Consequently, a higher incidence of dysthyroid optic neuropathy is observed in diabetic

subjects with Graves ophthalmopathy compared to non-diabetic.

AIMS AND OBJECTIVE OF THE STUDY

1. To study the prevalence of thyroid dysfunction in type-2 diabetes mellitus.
2. To classify type of thyroid dysfunction in type -2 diabetes mellitus and should thyroid function test be included in the investigation protocol of type-2 diabetes mellitus?

MATERIAL AND METHODS

Study design

We carried out a population based Prospective study over 1 ½ years of time period on patients attending General Medicine department of Santosh Medical College and Hospital, Ghaziabad.

Study Group (Sample size N=1000)

A total number of 1000 patients with type-2 Diabetes Mellitus of both gender attending Medicine OPD in Santosh Medical College and Hospital were included in the present study. Informed consent were taken from each patient included in the study and ethical clearance obtained from ethical committee of Santosh University.

The criteria used for selection of diabetic patients were

1. Fasting blood sugar ≥ 126 mg /dl (7.0 mmol/l).
2. Post prandial blood sugar ≥ 200 mg /dl (11.1 mmol/l)
3. Random blood sugar ≥ 200 mg /dl (11.1mmol/l)

The following patients were excluded from the study

1. Gestational diabetic mellitus.
2. Diabetes mellitus type -1
3. Other Exocrine or Endocrine disorder.
4. Stress diabetes mellitus.
5. Steroid induced diabetes mellitus.
6. Secondary thyroid disease.
7. Age < 40 years.
8. Recent onset diabetes mellitus.
9. Diabetes type -1 with long term complication ie.. microvascular and macrovascular complication.

METHODS

The thyroid profile were done according to the standard level set up at Santosh Medical College and Hospital.

The Thyroid profile were consider normal, if: TSH normal level - 0.3-5.5 mcg IU / ml, T3 normal level - 60-200 ng / dl., T4 normal level - 4.5- 12 mcg / dl.

1. **Primary Hypothyroidism:** Patient were considered hypothyroid, when TSH is more than 5.5 mcg IU / ml, and T3, T4 less than normal.

2. **Primary Hyperthyroidism:** Patient were considered hyperthyroid, when TSH is less than 0.3 mcg IU / ml and T3, T4 more than normal.
3. **Subclinical Hypothyroidism:** When Patient TSH is more than 5.5mcg IU / ml and T3, T4 levels are within normal range.
4. **Subclinical Hyperthyroidism:** When patient TSH is less than 0.3mcg IU/ ml and T3, T4 is within normal range.
 - The blood sugar was done by glucose uptake oxidase peroxidase method.
 - A detailed clinical evaluation of each case was done for the evidence of thyroid dysfunction.
 - Each case were subjected for thyroid function test (T3, T4 and TSH). T3 and T4 estimated by

Chemi Lumination Immuno Assay (CLIA) and TSH was estimated using ultra sensitive CLIA method.

Statistical Analysis: The results obtained and expressed in mean ± SD and chi square test.

OBSERVATION AND RESULTS

We conducted the study to find out the thyroid dysfunction prevalence among the type-2 diabetes mellitus patients at Santosh medical college Ghaziabad. The 333 patients with thyroid dysfunction of type-2 dependent diabetes mellitus show different clinical subtypes.

Table 1: Overall thyroid dysfunction in patients with type-2 diabetes.

Type of thyroid dysfunction	Number of Patients	Percentage of total Patients
Subclinical Hypothyroidism	111	11.1
Hypothyroidism	149	14.9
Hyperthyroidism	29	2.9
Subclinical Hyperthyroidism	49	4.9

Table 2: Shows Age-wise distribution of thyroid dysfunction in type-2 diabetic patients- Descriptive

Age in years	Type of thyroid dysfunction				Percentage of total Patients
	Subclinical Hypothyroid	Hypothyroid	Hyperthyroid	Subclinical Hyperthyroid	
40-49	47	23	2	17	8.9
50-59	26	45	8	12	9.1
60-69	32	47	13	14	10.6
70-79	6	29	0	6	4.1
80-89	0	0	6	0	0.6

Table 3: The level of fasting blood sugar in relation with types of thyroid dysfunction

Fasting sugar level in mg%	Type of thyroid dysfunction			
	Subclinical Hypothyroid	Hypothyroid	Hyperthyroid	Subclinical Hyperthyroid
126-150	63	90	17	41
151-175	20	15	4	3
176-200	22	35	2	2
201-225	1	2	1	1
226-250	1	2	1	0
251-275	2	1	2	2
276-300	1	1	2	1

Table 4: Fasting blood sugar (mg%) – Descriptive

Type of thyroid dysfunction	No. of Patients	Mean	Mean ±SD
Subclinical Hypothyroid	110	156.77	156.77±27.03
Hypothyroid	146	158.10	158.10±29.90
Hyperthyroid	28	152.78	152.78±23.85
Subclinical Hyperthyroid	51	142.56	142.56±15.75
Total	335	154.60	154.60±27.46

Table 5: The level of post prandial blood sugar in relation with type of thyroid dysfunction

Post Prandial blood sugar level in mg%	Type of thyroid dysfunction			
	Subclinical Hypothyroid	Hypothyroid	Hyperthyroid	Subclinical Hypothyroid
150-199	0	0	0	0
200-249	54	86	19	40
250-299	49	54	5	7
300-349	3	3	4	4
350-399	4	3	0	0

Table 6: Post Prandial blood sugar (mg%) – Descriptive

Type of thyroid dysfunction	No. of Patients	Mean	Mean± SD
Subclinical Hypothyroid	110	242.20	242.20±40.89
Hypothyroid	146	243.25	243.25±41.09
Hyperthyroid	28	247.57	247.57±38.71
Subclinical Hyperthyroid	51	243.17	243.17±40.53
Total	335	254.14	254.14±42.27

DISCUSSION

We studied 1000 randomly selected patients of type-2 diabetes mellitus who attended our hospital as an OPD patient. The thyroid dysfunction in these type-2 diabetic patients increases the co-morbidity. In our study of randomized 1000 patients of type-2 diabetes mellitus, 333 patients showed alternation in the thyroid profile. This

account of an incidence of 33.3% of thyroid dysfunction in type-2 diabetes mellitus patients. The prevalence of thyroid dysfunction in our study was 14.4% hypothyroid, 2.9% hyperthyroid, 11.1% subclinical hypothyroid and 4.9% subclinical hyperthyroid respectively (vide Table – 7).

Table 7: Showing prevalence of Thyroid dysfunction in type-2 diabetes mellitus by different studies.¹²⁻¹⁵

Studies	Type of thyroid dysfunction				Total percentage
	Subclinical Hypothyroid	Hypothyroid	Hyperthyroid	Subclinical Hyperthyroid	
Perros <i>et al</i> (1995)	4.8%	0.9%	0.5%	0.5%	6.7%
Smithson <i>et al</i> (1998)	1.8%	2.5%	0.45%	0.45%	5.2%
Akbar <i>et al</i> (2006)	16.3%	11.4%	2.0%	1.5%	31.2%
J J Diez <i>et al</i> (2011)	10.7%	15.1%	3.5%	3.1%	32.4%
Laloo Demitros (2012)	16.3%	11.4%	1.5%	2.0%	31.2%
Present Study	11.1%	14.4%	2.9%	4.9%	33.3%

Differences between our findings and those in other studies may be accounted for by diverse factors. Geographical locations and ethnic characteristics are variation factors in epidemiological studies. Differences in dietary iodine intake in the diverse populations and methods to quantify TSH also influence results.

CONCLUSION

The study was done in Santosh Medical College during 1 ½ years period. We studied the prevalence of thyroid dysfunction in 1000 type -2 diabetes mellitus patients. The conclusion of our study is summarized below.

1. In our study the prevalence of thyroid dysfunction in type-2 Diabetes mellitus patients was substantially higher. The prevalence was 33.3% in the study group.
2. Maximum number of diabetic patient were of the 40-49 years of age group.
3. Among the thyroid dysfunction, maximum number of patients was suffering from hypothyroidism (14.4% of the total study group) and followed by subclinical hypothyroidism (11.1% of total study group).
4. The age group having maximum number of thyroid dysfunction in type-2 diabetes mellitus patients was 60-69 years having 106 patients i.e. 10.6% of total study group.

Thyroid dysfunction in the current study and prevalence of overall thyroid disease is 33.3% which is higher than

other comparable study. On the basis of the finding of present study it is recommend to includes screening of thyroid dysfunction in patients with type-2 diabetes mellitus.

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