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A Study On Thyroid Dysfunction Profile Among Type 1 Diabetes

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Abstract

Background

Thyroid disorders are mutually influenced by Diabetes mellitus and the association between the two endocrine disorders were been long reported. Many reports infer a higher prevalence of thyroid dysfunction in Diabetes Mellitus than in the normal population. Type 1 diabetes mellitus patients have a high prevalence of thyroid dysfunction with nearly one-third of all newly detected patients showing thyroid autoimmunity.

Objectives: To elucidate the prevalence of various thyroid dysfunctions among type 1 Diabetics in the South Indian population.

Materials and Methods: This cross-sectional study included 159 diagnosed with type 1 Diabetes and insulin-dependent patients enrolled in the registry of the Diabetology OPD from 2018 to 2020 at a tertiary care center in Chennai. Clinical history and examination were done for all included subjects and subjected to serum-free thyroxine (T4), serum-free triiodothyronine (T3), and serum thyroid-stimulating hormone (TSH). Data were entered in an MS Excel sheet and analyzed using SPSS software version 21.

Results: Out of 159 subjects, 64 (40.3%) were males and 95 (59.7%) were females. 20% of the population (262/159 subjects) had an abnormal thyroid function of which 21 (13.2%) had subclinical hypothyroidism, 10 (6.3%) had evident hypothyroidism and 2 (1.2%) had hyperthyroidism. The mean duration of Diabetes among the subjects was 8.81 (± 7.01) years ranging from 0 to 32 years. In the study population, the mean age at diagnosis of type 1 Diabetes was 17.45 (± 7.79) years ranging from 1 to 40 years. **Conclusion:** The prevalence of thyroid dysfunction among the type 1 Diabetes population was 20% and the prevalence of subclinical hypothyroidism is high among it. To prevent the complications of thyroid disorders, patients with type 1 Diabetes should be subjected to regular screening for thyroid function tests to detect subclinical and clinical hypothyroidism as well as hyperthyroidism.

Keywords: Type 1 Diabetes, hypothyroidism, thyroid dysfunction

Introduction

Diabetes Mellitus is the most common endocrine disorder in the world and contributes a major worldwide burden compared to other diseases.[1] Type 1 diabetes was called insulin-dependent diabetes which has incidence at any age but is most frequently seen in children and young people. Type 1 diabetes comprises about 5%–10% of overall cases of diabetes. In type 1 diabetes, there is beta cell destruction in the pancreas which leads to poor insulin production and eventually they become insulin dependent. The incidence of type 1 diabetes is 15 per 100,000 people and the prevalence is 9.5% in the world.[2]Thyroid disorders are mutually

influenced by Diabetes mellitus and the association between the two endocrine disorders has been long reported.[3] With insulin and thyroid hormones correlated with each other in cellular metabolism, imbalance in any of these hormones could result in functional derangement of the other hormone.[4] NHANES III (National Health and Nutrition Examination Survey) study done on the US population reported hypothyroidism in 4.6% and hyperthyroidism in 1.3%. The study also reported a higher prevalence of thyroid disease in women compared to men and in diabetic subjects compared to non-diabetics.[5] Many reports infer a higher prevalence of thyroid dysfunction in Diabetes Mellitus than in the normal population.[6] [7] Also 38% of Diabetic patients show positive thyroid peroxidase (TPO) antibodies and it was predictive of the development of clinical and subclinical hypothyroidism.[8] Type 1 diabetes mellitus patients have a high prevalence of thyroid dysfunction with nearly one-third of all newly detected patients showing thyroid autoimmunity.[4]Thus, it is clear that thyroid dysfunction is evident in type 1 Diabetes but the prevalence of different type of thyroid dysfunction varies between different studies. Hence this study aimed to elucidate the prevalence of various thyroid dysfunctions among type 1 Diabetics in South Indian population.

Materials and Methods

The study was conducted as a cross-sectional observational study at a government tertiary care hospital in Chennai, South India. For the patients enrolled in the registry of the Diabetology OPD from 2018 to 2020, the Department of Diabetology was taken as the study population. Those patients diagnosed with type 1 Diabetes and insulin-dependent were included in the study. Patients with acute complications of type 1 diabetes like hypoglycemia or ketoacidosis, diagnosed with thyroid disorders or undergoing treatment for any thyroid disorder, and consuming drugs that influence thyroid functions were excluded from the study. Those subjects who fulfilled the above-mentioned criteria were included in the study. Approval from Institutional Ethics Committee was obtained before the start of the study. Informed written consent was obtained from each patient before participation in the study. Clinical history and examination were done for all included subjects, and they were subjected to the following investigations: serum-free thyroxine (T4), serum-free triiodothyronine (T3), and serum thyroid-stimulating hormone (TSH).

Statistical Analysis: Data was entered into an MS Excel sheet and analyzed using Statistical Package for the Social Sciences (SPSS) software version 21. Continuous variables like thyroid profile markers were represented in mean and standard deviation. Categorical variables like age group and gender were represented in frequencies and percentages. ANOVA test was used to determine the difference between the means. p values less than 0.05 were considered statistically significant.

Results:159 type 1 Diabetes diagnosed cases were enrolled in the study. Out of which, 64 (40.3%) were males and 95 (59.7%) were females. The males and females were almost equally distributed in all age groups, but females were slightly higher in younger age groups. (Fig - 1)The age of the participants varied from 12 years to 46 years with a mean age of 26.25 (± 8.96) years. The mean duration of Diabetes among the subjects was 8.81 (± 7.01) years ranging from 0 to 32 years. In the study population, the mean age at diagnosis of type 1 Diabetes was 17.45 (± 7.79) years ranging from 1 to 40 years. (Table - 1) Regarding the distribution of thyroid function among the study population, 79.2% of the population (126 subjects) had a normal thyroid function. Among the remaining population 33 (20.7%) had thyroid dysfunction, 21 (13.2%) had subclinical hypothyroidism, 10 (6.3%) had evident hypothyroidism and 2 (1.2%) had hyperthyroidism. (Fig - 2) The study population had a mean free T4 of 1.29 (± 0.42) ranging from 0.4 – 4.4 ng/dL, a mean free T3 of 4.09 (± 0.76) ranging from 2 to 7 pmol/L and a mean TSH of 5.14 (± 12.68) ranging from 0.1 to 100 mIU/L. (Table 1)

Volume 5, Issue 5; September-October 2022; Page No 777-782

Fig 1: Distribution of age group and sex among the study population

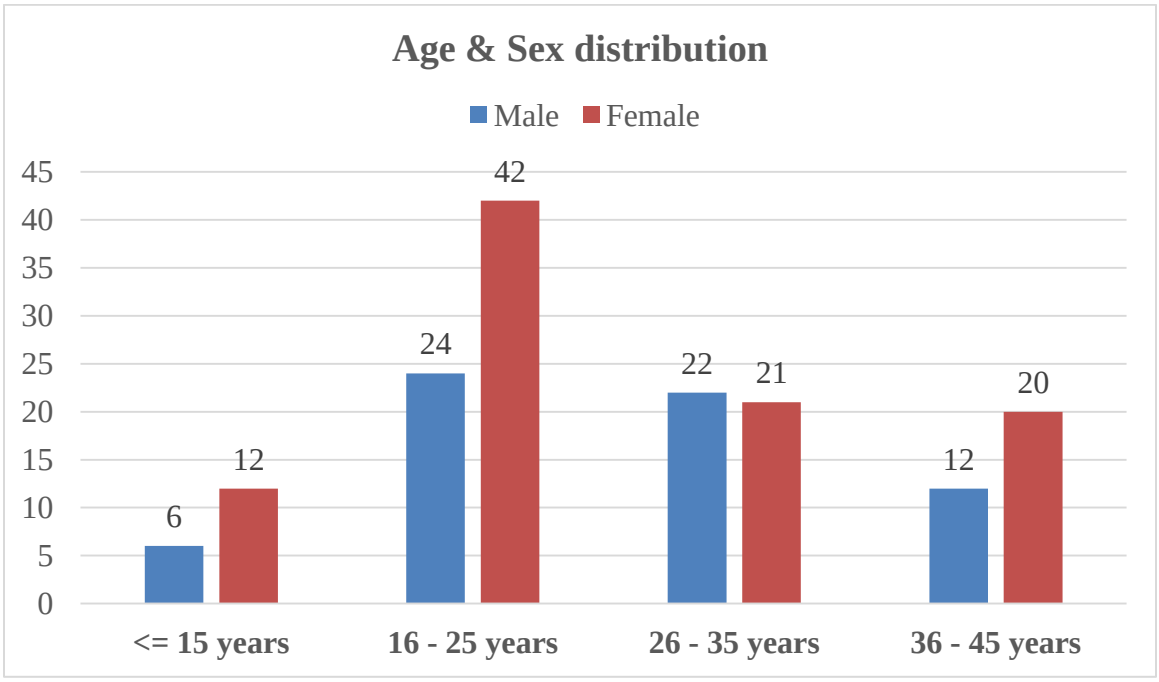
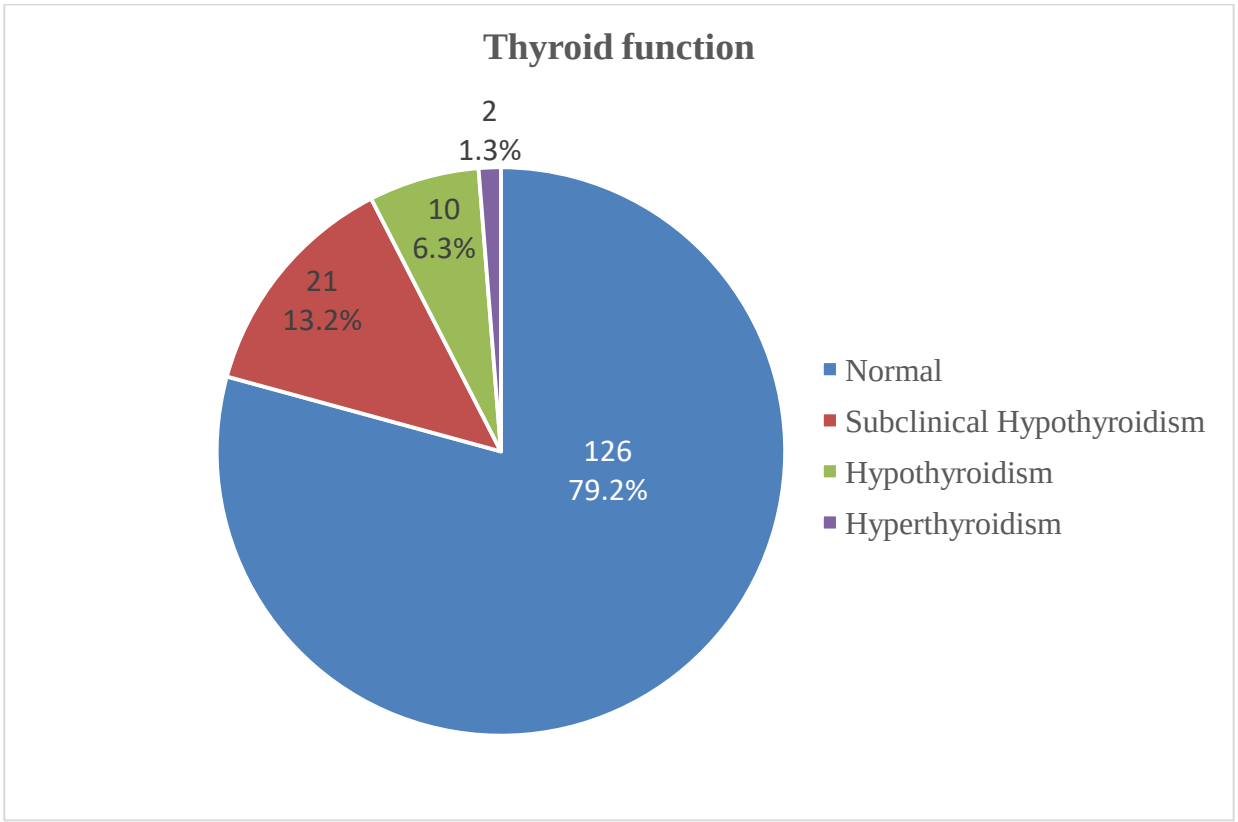


Fig 2: Distribution of Thyroid function among the study population



Volume 5, Issue 5; September-October 2022; Page No 777-782

Table 1: Distribution of characteristics of thyroid function among the study population

	Normal	Subclinical Hypothyroidism	Hypothyroidism	Hyperthyroidism	Overall	Range
Age at Diagnosis of Diabetes (years)	17.8 (± 7.9)	16.3 (± 8.1)	17.1 (± 7.2)	12.5 (± 2.1)	17.45 (± 7.79)	1 – 40
Duration of Diabetes (years)	8.3 (± 6.6)	9.8 (± 7.2)	8.8 (± 5.1)	30.5 (± 0.7)	8.81 (± 7.01)	0 - 32
Serum Free T4 ng/dl	1.3 (± 0.3)	1.2 (± 0.2)	0.9 (± 0.4)	3.6 (± 1.1)	1.29 (± 0.42)	0.4 – 4.4
Serum Free T3 pmol/L	4.2 (± 0.8)	3.8 (± 0.5)	4.1 (± 0.7)	3.2 (± 0.8)	4.09 (± 0.76)	2 - 7
Serum TSH mIU/L	2.1 (± 0.9)	6.5 (± 1.9)	41.4 (± 34.7)	0.1 (± 0)	5.14 (± 12.68)	0.1 – 100

Normal thyroid function subjects had a higher mean of age at diagnosis with 17.75 years followed by hypothyroidism subjects with 17.1 years and least in hyperthyroidism subjects with 12.5 years. Hyperthyroidism subjects had a higher mean duration of diabetes with 30.5 years followed by subclinical hypothyroidism subjects with 9.76 years and 8.8 years of hypothyroidism subjects. Hyperthyroidism subjects had a higher mean of free T4 with 3.6 ng/dl followed by normal subjects with 1.31 ng/dl and least in hypothyroidism subjects with 0.87 ng/dl. Normal subjects had a higher mean of free T3 with 4.15 pmol/L followed by hypothyroidism subjects with 4.13 pmol/L and least in hyperthyroidism subjects with 3.2 pmol/L. Hypothyroidism subjects had a higher mean of TSH with 41.36 mIU/L followed by subclinical hypothyroidism subjects with 6.54 mIU/L and least in hyperthyroidism subjects with 0.1 mIU/L.

Discussion

Diabetes mellitus and thyroid dysfunction go hand in hand. Many mechanisms are involved by the thyroid hormones in affecting glucose metabolism. Hyperthyroidism has long been recognized to promote hyperglycemia.[12] During hyperthyroidism, the half-life of insulin is reduced most likely secondary to an increased rate of degradation and an enhanced release of biologically inactive insulin precursors.[13]

In diabetes mellitus individuals with euthyroid levels, the glycemic status influences the serum T3 levels, basal TSH levels, and TSH response to thyrotropin-releasing hormone (TRH).[14] Poorly controlled diabetes, both Type 1 and Type 2, may induce a "Low T3 state" characterized by low serum total and free T3 levels, an increase in reverse T3 (rT3) but near normal serum T4 and TSH concentrations.[15] Low serum T3 is due to reduced peripheral conversion of thyroxine (T4) to tri-iodothyronine (T3) via a 5' monodeiodination reaction. Studies indicate that it may be the long term diabetic control that determines the plasma T3 levels.[14] Poorly controlled diabetes may also result in impaired TSH response to TRH or loss of normal nocturnal TSH peak. TSH responses and "low T3 state" may normalize with improvement in glycemic status but even with good diabetes control, the normal nocturnal TSH peak may not be restored in C-peptide negative patients i.e. those with totally absent pancreatic beta cell function.[16]

Volume 5, Issue 5; September-October 2022; Page No 777-782

The prevalence of various thyroid dysfunction varies in different reports. The current study reports thyroid dysfunction in 20.7% of type 1 Diabetes subjects in the study population. Rajesh Gosavi et al[9] conducted a study on thyroid dysfunction among the type 1 Diabetes population in Maharastra and reported a prevalence of 14.63%. Perros P et al[6] measured the frequency of thyroid dysfunction among 406 types 1 Diabetic patient and showed a prevalence of 22.6%. Guillermo EU et al [17] analyzed the incidence of thyroid dysfunction among 58 cohort patients of type 1 diabetes mellitus and detected a prevalence of 33% thyroid dysfunction among type 1 Diabetics. Peters et al[18], a part of Fremantle Diabetes Study Phase II, showed thyroid dysfunction of 16.9% among 130 types 1 Diabetic subjects. Due to geographical differences, the prevalence of thyroid function varies from 14% to 22%.

The present study depicted the profile of thyroid dysfunction as follows: 13.2% had subclinical hypothyroidism, 6.3% had hypothyroidism and 1.2% had hyperthyroidism. Perros P et al showed 10.56% of hypothyroidism, 7.6% of subclinical hypothyroidism, and 4% of hyperthyroidism among type 1 Diabetics. Rajesh Gosavi et al inferred 7.3% hypothyroid and 7.3% of hyperthyroid patients among their study population. Peters et al found 6.4% of hypothyroidism and 1.8% of hyperthyroidism among type 1 Diabetics. Sajid et al[19] reported 11.1% of hypothyroidism and 3.9% of hyperthyroidism among type 1 Diabetics. Thus, a major part of thyroid dysfunction in type 1 Diabetes is contributed by hypothyroidism which may be clinical as well as subclinical followed by hyperthyroidism.

Conclusion

The prevalence of thyroid dysfunction among the type 1 Diabetes population was 20.7% and the prevalence of subclinical hypothyroidism is high among it. To prevent the complications of thyroid disorders, patients with type 1 Diabetes should be done the regular screening for thyroid function tests to detect subclinical and clinical hypothyroidism as well as hyperthyroidism.

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Volume 5, Issue 5; September-October 2022; Page No 777-782

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Volume 5, Issue 5; September-October 2022; Page No 777-782