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Original Research Article

Study on Prevalence of Thyroid Dysfunction and Associated Risk Factors Among Type 1 Diabetes Mellitus Patients from South India

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Conflict of interest: Nil

Abstract

Background: Type 1 Diabetes Mellitus is a chronic endocrine disorder of children and early adults of autoimmune origin. Diabetes mellitus is being one of the greatest health threats for the 21st century. Because of high prevalence, lack of clinical features and the impact on morbidity, most investigators recommend screening children and adolescents with type 1diabetes for autoimmune thyroid disease. Thus, the aim of the study is to find the prevalence of thyroid disorder status in type 1 diabetes mellitus.

Method: Data were collected from 50 type 1 Diabetic patients. Thyroid dysfunction was said to occur if patients thyroid hormones fall outside the reference range (free T3 (4.0– 8.3 pmol/L), free T4 (9.0–20.0 pmol/L), and TSH level (0.25 – 5mIU/L). Collected data was entered in Microsoft excel 2016 for further analysis, statistical analysis was done by using SPSS version 25.

Results: The prevalence of thyroid disorder was found to be 20% in type 1 DM. Population comprised 50% males and 50 % females with mean age of 44.2±19.2 years. The mean age of males and females was 48.23 ± 12.3 years and 44.3 ± 13.4 years, respectively. It was observed that smoking hobbit and hypertension, family history of thyroid disease and female were the risk factor for thyroid dysfunction.

Conclusion: The present study identifies thyroid dysfunction, as well as prominently subclinical hypothyroidism, and also some risk factors were associated in type 1 diabetes mellitus. Thus, regular screening of thyroid disorder, specially in family history of thyroid is recommended in this study.

Keywords: Diabetes Mellitus, Thyroid Dysfunction, Hypothyroidism, subclinical Hypothyroidism.

Introduction

Diabetes mellitus is being one of the greatest health threats for the 21st century. Also Diabetes Mellitus (DM) and thyroid dysfunction (TD) are the two most common endocrine disorders in clinical practice [1]. The association between DM and TD is widely known, with the first studies published in 1979 [2]. Since then, several studies in different countries were conducted to estimate the prevalence of TD in diabetic patients. There is great variability in the prevalence of TD in

general population, ranging from 6.6% to 13.4% [3,4]. In diabetic patients, the prevalence is still greater and varies from 10 to 24% [4,5].

Type 1 Diabetes mellitus is a chronic autoimmune disorder of children and early adulthood due to destruction of beta pancreatic cells resulting in absolute insulin deficiency leading to both microvascular and macrovascular complications in due course of time.

As Type 1 diabetes mellitus is a common endocrine disorder associated with aberrant immune responses to specific β-cell autoantigens including autoantibodies to glutamic acid decarboxylase (GAD), to islet cell (ICA) and to insulin (IAA), these patients are also prone to other autoimmune disorders such as Graves‟ disease, Hashimoto's thyroiditis, Addison's disease, vitiligo, celiac sprue, autoimmune hepatitis, myasthenia gravis, and pernicious anemia [6]. Using these autoantibodies, organ-specific autoimmunity may be detected before the development of clinical disease. The most common autoimmune disease associated with T1DM is autoimmune thyroid disorder, which is characterized by the presence of thyroid antibodies especially thyroid peroxidase and thyroglobulin [7]. In type 1 DM, the prevalence of thyroid antibodies in children is 8 to 50% from various studies in different nations due to variation in age, sex, and ethnic origin of the people.

Because of this high prevalence, lack of clinical features and the impact on morbidity, most investigators recommend screening children and adolescents with type 1diabetes for autoimmune thyroid disease. Early detection has the potential to prevent significant morbidity related to unrecognized disease [7]. Thus, in this study we are going to see the prevalence of thyroid disease and associated risk factors among diabetic patients.

Material and Methodology:

This cross-sectional study conducted in Department of General Medicine, MNR medical college and Hospital, sangareddy, during period of March 2019 to December 2020. A total of 50 patients with diabetes mellitus were selected during the study period. Study is approved by institutional ethical committee.

Inclusion Criteria:

1. Symptoms of diabetes and casual plasma glucose 200 mg/dl.
2. Patient on insulin from the time of diagnosis of diabetes.
3. Patients age more than 15 years.

Exclusion Criteria:

1. Patients age less than 15 years
2. Pregnant women.
3. Past history of thyroid surgery or radioiodine therapy.
4. Multinodular goiter and known thyroid disease on medication.
5. Evidence of other autoimmune diseases like Addisons disease, vitiligo, autoimmune hepatitis, rheumatoid arthritis, SLE.

Methodology:

Each subject demographic (age, sex) and anthropometric measurements (height, weight, and BMI) including blood pressure (systolic and diastolic), duration of diabetes, family history of diabetes mellitus and thyroid disease, and alcohol intake habit and smoking habit was recorded. About 5mL overnight fasting venous blood samples were collected at morning time from each patient and sent for analysis and free triiodothyronine (T3), free tetraiodothyronine (T4), and thyroid stimulating hormone (TSH) were estimated. Serum free T3, free T4, and TSH were measured by using fluorescent immunoassay. Thyroid dysfunction was said to occur if patients thyroid hormones fall outside the reference range (free T3 (4.0– 8.3 pmol/L), free T4 (9.0–20.0

pmol/L), and TSH level (0.25 – 5mIU/L)). Collected data was entered in Microsoft excel 2016 for further analysis, statistical analysis was done by using SPSS version 25. Qualitative data were presented by frequency and proportion and percentage difference between the proportion were assessed by chi-square test. Quantitative data were presented by using mean and standard deviation and mean difference was assessed by t-test. P-value less than 0.05 consider as statistically significant.

Result and Observation:

The study population comprised 50% males and 50 % females with mean age of 44.2±19.2 years. The mean age of males and females was 48.23 ± 12.3 years and 44.3 ± 13.4 years, respectively. The mean BMI among the patients was 28.26 ± 4.23. Euthyroidism, and overt hypothyroidism, among study population were 80% (n = 40), and 20% (n = 17), respectively.

Table 1: Basic characteristics of study population.

Parameter	Euthyroid (n=40)	Subclinical Hypothyroidism + Hypothyrodism (n=10)	Total (n=50)	P-value
Gender				
Male	22(55%)	3(30%)	25(50%)	0.289
Female	18(45%)	7(70%)	25(50%)	
Age	48.3±15.2	42.3±23.3	44.2±19.2	0.751
Diabetes Duration	3.33±2.19	3.45±3.34	3.35±2.42	0.89
Alcoholism	10(20%)	2(4%)	12(24%)	0.02
Smoking Hobbit	15(30%)	4(8%)	19(38%)	0.01
Hypertension	13(26%)	3(6%)	16(32%)	0.012
Family History of Diabetes	13(26%)	6(12%)	19(38%)	0.108
Family History of Thyroid	16(32%)	5(10%)	21(42%)	0.016

Mean age of the patients in Euthyroid was 48.3±15.2 years and that of patients with Hypothyroidism was 42.3±23.3 years and this difference was statistically not significant. Duration of the thyroid disease between euthyroid and Hypothyroid patients was statistically not significant. We observed 12(24%) of the patients were alcoholic among them 4% had hypothyroid, among 19(38%) patients with smoking hobbit 8% of the patients with hypothyroidism and among 16 patients with hypertension 6% of the patients had hypothyroidism and this difference between proportion between euthyroid and hypothyroid was statistically significant shown in above table. Among the diabetic patients 19(38%) of the patients had family history of Diabetic and among them 12% of the patients had hyperthyroidism. Total 21(42%) of the patients had family history of thyroid and of them 10% of the patients had hypothyroidism.

Table 2: Thyroid parameters of study population.

Parameter	Euthyroid (n=40)	Subclinical Hypothyroidism + Hypothyroidism (n=10)	Total (n=50)	P-value
T3 (pmol/L)	4.23±1.07	3.43±1.21	3.89±1.056	<0.001
T4 (pmol/L)	6.988±1.97	5.8±1.69	6.75±1.96	<0.05
TSH (mIU/L)	3.22±1.05	12.69±8.43	5.12±5.34	<0.001

It was observed that smoking hobbit and hypertension were the risk factor for thyroid dysfunction with relative risk 2.87 (1.56–3.1, $p < 0.001$), 2.42 (1.84–2.98, $p < 0.001$), also family history of thyroid disease was also one of the risk factor with relative risk 2.58 with 95% CI (1.64–2.81, $p < 0.001$)), and female gender with relative risk 1.72 with 95% CI (1.43–1.96, $p = 0.032$).

Discussion:

Diabetic patients have susceptibility to different types of thyroid dysfunction, whether hypothyroidism or hyperthyroidism; at the same time, patients with thyroid dysfunction are susceptible to suffer from either type 1 diabetes or type 2 diabetes [8]. Diabetic patients have a higher prevalence of TD compared with the normal people because patients with one organ-specific autoimmune disease usually are likely to develop other autoimmune disorders [9]. Triiodothyronine (T3), thyroxine (T4) and thyroid-stimulating hormone (TSH) are the three hormones measured to diagnose thyroid dysfunction. Initial screening of type 1 diabetic patients at the time of diagnosis, for the presence of thyroid antibodies was done by Gemma et al [10] in march 2007.

In respect with gender, in our study we found that, among all hypothyroid cases maximum cases were female, 70% of the of the female were with hypothyroidism. Generally thyroid autoimmunity is more common in females than in males, this holds good for T1DM also as per many cross-sectional as well as prospective studies. In our study also, there is preponderance for female to develop thyroid autoimmunity. Gemma C et al [10] reported female preponderance. 18.3% females had AITD whereas it was 7% in males. Olga Kordonouriet al [11] showed a similar female preponderance and they had 63% of AITD patients as females. Reports by Holl RW et al [12], O Kordonouri et al [11], Adriana Franzese et al [13], Jennifer M. Barker et al [14] support this gender difference. Menon PS et al [15] showed that sex doesn't influences the development of thyroid autoimmunity among Indian paediatric population.

As in general population, thyroid autoimmunity is expected to be more common in female.

The reported prevalence of thyroid dysfunction in diabetic population varies widely between studies. The present study finds thyroid dysfunction as a common endocrine disorder in diabetic patients, where we reported that 20% diabetic patients had thyroid dysfunction. Studies have reported high prevalence of thyroid dysfunction in Nepal even in the general population. A hospital-based study by Baral et al. in eastern Nepal reported hypothyroidism and hyperthyroidism in 17.19% and 13.68% population, respectively [16]. Similarly, in a study in Kavre district of central Nepal, thyroid dysfunction was observed in 31.84% metabolic syndrome patients [17]. While iodine nutrition has been rapidly improving in the past years in Nepal, excess iodine intake, as indicated by recent studies in school children of eastern Nepal, could also be a responsible factor for the high prevalence of thyroid dysfunction specifically hypothyroidism in our study population. Both iodine excess and

deficiency have been found to affect thyroid gland function [9].

The present study reveals that hypertension (32%), smoking habit (38%), alcohol intake (24%), family history of diabetes mellitus (38%), and family history of thyroid disease (42%) are common among the study population. Among the various risk factors for thyroid dysfunction we studied, smoking, Hypertension, family history of thyroid disease, and female gender had significant risk for thyroid dysfunction, specifically hypothyroidism. Similarly, Al-Geffari et al. found family history of thyroid disease, female gender, and duration of diabetes of >10 years as significant risk factor for thyroid dysfunction in type 2 diabetic patients [18]. In another study by Papazafiropoulou et al., who reported that presence of thyroid dysfunction was related with gender and LDL cholesterol levels in type 2 diabetic patients [19].

Thyroid function test is not a commonly recommended investigation in patients with diabetes Based on our findings and the reported harmful effects of low thyroid hormones on cardiovascular health, we recommend the frequent screening (1-2 years) of thyroid function in patients with diabetes. Our findings provide evidence for the importance and necessity of thyroid function screening in patients with diabetes. This will assist in better clinical management of diabetes patients. The present study has however few limitations.

The prevalence of anti-TPO antibodies in the study population could not be assessed. Assessment of anti-TPO antibodies would have provided clues for the thyroid autoimmunity status in the study population, which could have helped to explain the high rate of thyroid dysfunction.

Conclusion:

From overall observation and analysis done, the present study identifies thyroid dysfunction, as well as prominently subclinical hypothyroidism, as a common disorder in type 1 diabetes mellitus, most of the patients develop subclinical form of disease. smoking, family history of thyroid disease, and female gender were associated with thyroid dysfunction (mainly hypothyroidism) in the study population. Thus, regular screening of thyroid disorder, specially in family history of thyroid is recommended in this study.

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