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A STUDY ON THE PREVALENCE OF AUTOIMMUNE THYROID DISEASE IN PATIENTS WITH TYPE 1 DIABETES.

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Abstract

Introduction: Type 1 Diabetes Mellitus (T1DM) is an autoimmune disorder commonly associated with other endocrine autoimmune diseases, particularly autoimmune thyroid disease (AITD). Thyroid dysfunction in patients with T1DM may adversely affect glycemic control and increase the risk of long-term metabolic complications. Early identification of thyroid autoimmunity is therefore important for timely management and prevention of associated morbidity. The present study aimed to determine the prevalence of autoimmune thyroid disease among patients with Type 1 Diabetes Mellitus and to evaluate its clinical, biochemical, and immunological associations. ***Materials and Methods:*** This hospital-based cross-sectional study was conducted in the Department of General Medicine, Mahatma Gandhi Memorial Hospital, Warangal, over a period of two years from May 2023 to April 2025. A total of 150 patients with Type 1 Diabetes Mellitus were included in the study after obtaining informed consent. Detailed clinical evaluation, biochemical investigations, thyroid function tests, Anti-TPO antibodies, TRAb antibodies, HbA1c, C-peptide levels, and thyroid ultrasonography were performed. ***Results:*** Among the 150 patients studied, 78 (52.0%) were males and 72 (48.0%) were females. Autoimmune thyroid disease was identified in 41 (27.33%) patients. Hypothyroidism was the most common thyroid dysfunction, while hyperthyroidism was observed in a smaller proportion of patients. Significant associations were observed between AITD and female sex ($p < 0.0001$), hypothyroidism ($p < 0.0001$), and hyperthyroidism ($p = 0.0062$). Diffuse thyroid enlargement and nodular thyroid changes were the predominant ultrasonographic findings. Anti-TPO positivity was markedly higher among females with hypothyroidism. Logistic regression analysis did not identify any statistically significant independent predictors of AITD. ***Conclusion:*** The present study demonstrated a high prevalence of autoimmune thyroid disease among patients with Type 1 Diabetes Mellitus, with hypothyroidism being the predominant thyroid disorder. Female patients showed increased susceptibility to thyroid autoimmunity. Routine screening for thyroid dysfunction and thyroid autoantibodies in T1DM patients may facilitate early diagnosis and timely management, thereby reducing long-term endocrine complications.

Keywords: Type 1 Diabetes Mellitus; Autoimmune Thyroid Disease; Hypothyroidism; Anti-TPO Antibodies; Thyroid Autoimmunity.

INTRODUCTION

Type 1 Diabetes Mellitus (T1DM) is a chronic autoimmune disorder characterized by destruction of pancreatic β-cells, resulting in absolute insulin deficiency and lifelong dependence on exogenous insulin therapy [1,2]. It commonly affects children and young adults, although it may occur at any age. Apart from metabolic disturbances, patients with T1DM are predisposed to several autoimmune disorders due to underlying immune dysregulation [3]. Among these, autoimmune thyroid disease (AITD) is considered one of the most frequent endocrine comorbidities associated with T1DM [4].

Autoimmune thyroid disease encompasses a spectrum of disorders including Hashimoto's thyroiditis and Graves' disease, characterized by the presence of thyroid autoantibodies such as anti-thyroid peroxidase (Anti-TPO) antibodies and thyrotropin receptor antibodies (TRAb) [5]. Thyroid dysfunction in patients with T1DM may present as hypothyroidism or hyperthyroidism and can significantly influence glycemic control, growth, metabolism, cardiovascular risk, and overall quality of life [5]. The coexistence of T1DM and AITD is often regarded as a component of autoimmune polyglandular syndromes, reflecting a shared genetic and immunological predisposition [6].

Several studies across different populations have demonstrated an increased prevalence of thyroid autoimmunity among patients with T1DM compared to the general population [7]. Female sex, longer duration of diabetes, and poor glycemic

control have been reported as potential risk factors for thyroid dysfunction in diabetic individuals [8]. Early identification of thyroid autoimmunity through screening of thyroid function tests and thyroid autoantibodies is essential, as many patients remain asymptomatic during the initial stages of disease [9]. Timely diagnosis and management of thyroid disorders can reduce complications and improve metabolic outcomes in patients with T1DM [10,11].

Despite the recognized association between T1DM and autoimmune thyroid disease, limited data are available regarding its prevalence and clinical profile in the regional population attending tertiary care centers in Telangana. Therefore, the present study was undertaken to determine the prevalence of autoimmune thyroid disease among patients with Type 1 Diabetes Mellitus and to evaluate its clinical, biochemical, and immunological associations.

MATERIALS AND METHODS

This hospital-based cross-sectional study was conducted in the Department of General Medicine, Mahatma Gandhi Memorial Hospital (MGMH), Warangal, over a period of two years from May 2023 to April 2025. The study included patients attending the outpatient department as well as those admitted to the inpatient medical wards. A total of 150 patients diagnosed with Type 1 Diabetes Mellitus (T1DM) were enrolled in the study after obtaining informed written consent. The study aimed to determine the prevalence of autoimmune thyroid disease (AITD) among patients with T1DM and to evaluate its clinical and biochemical associations.

Patients with confirmed Type 1 diabetes mellitus who fulfilled the inclusion criteria were included in the study. Patients who were unwilling to participate, those with sepsis, patients receiving corticosteroid therapy, individuals with pre-existing thyroid disorders, and patients diagnosed with Type 2 diabetes mellitus were excluded from the study. A detailed clinical history was obtained from all participants, followed by a comprehensive physical examination. Demographic details, duration of diabetes, anthropometric measurements, and clinical findings were documented using a predesigned and pre-coded clinical proforma.

Laboratory investigations included fasting blood sugar (FBS), postprandial blood sugar (PPBS), random blood sugar, glycated hemoglobin (HbA1c), urine examination, thyroid function tests, C-peptide levels, anti-thyroid peroxidase (Anti-TPO) antibodies, and thyrotropin receptor antibodies (TRAb). Thyroid ultrasonography (USG) was performed in patients who demonstrated evidence of thyroid autoimmunity or thyroid dysfunction. Patients were categorized as AITD-positive based on abnormal thyroid function tests and/or positivity for thyroid autoantibodies. Hypothyroidism and hyperthyroidism were classified according to standard biochemical criteria.

All collected data were entered into Microsoft Excel and analyzed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Comparison between AITD-positive and AITD-negative groups was performed using independent sample t-test for continuous variables and Chi-square test for categorical variables. Logistic regression analysis was performed to identify independent predictors of autoimmune thyroid disease among patients with T1DM. A p-value of <0.05 was considered statistically significant throughout the study.

RESULTS

The study included 150 patients with Type 1 Diabetes Mellitus (T1DM), of whom 78 (52.0%) were males and 72 (48.0%) were females, indicating a nearly equal gender distribution in the study population. The mean age of the study participants was 20.97 ± 3.91 years, while the mean duration of T1DM was 5.91 ± 3.50 years. The average BMI was 22.27 ± 3.70 kg/m². Mean fasting blood sugar (FBS) and postprandial blood sugar (PPBS) levels were 190.07 ± 77.25 mg/dL and 252.15 ± 84.11 mg/dL, respectively, reflecting suboptimal glycemic control among the participants (Table 1).

Table 1: Descriptive Statistics of Clinical Parameters Among Patients with Type 1 Diabetes Mellitus

Parameter	Mean ± SD	Median (IQR)	Minimum	Maximum
Age (years)	20.97 ± 3.91	21.0 (18.0–23.75)	11	29
Duration of T1DM (years)	5.91 ± 3.50	6.0 (4.0–7.0)	1	15
BMI (kg/m²)	22.27 ± 3.70	22.35 (19.62–25.05)	2.6	28.5
FBS (mg/dL)	190.07 ± 77.25	162.0 (131.0–251.8)	90	350
PPBS (mg/dL)	252.15 ± 84.11	236.5 (191.2–289.5)	112	443

Autoimmune thyroid disease (AITD) was present in 41 (27.33%) patients, whereas 109 (72.67%) patients did not have evidence of thyroid autoimmunity, indicating a considerable prevalence of AITD among patients with T1DM (Table 2).

Table 2: Prevalence of Autoimmune Thyroid Disease Among Patients with Type 1 Diabetes Mellitus

AITD Status	Frequency	Percentage
Present	41	27.33
Absent	109	72.67
Total	**150**	**100.0**

Comparison between AITD-positive and AITD-negative patients showed no statistically significant differences with respect to age, duration of diabetes, BMI, fasting blood sugar, or postprandial blood sugar levels ($p > 0.05$ for all variables) (Table 3).

Table 3: Comparison of Clinical Parameters Between AITD-Positive and AITD-Negative Patients

Variable	AITD Positive (Mean ± SD)	AITD Negative (Mean ± SD)	p-value
Age (years)	21.42 ± 3.94	20.81 ± 3.90	0.401
Duration of T1DM (years)	6.10 ± 3.91	5.84 ± 3.35	0.715
BMI (kg/m²)	21.74 ± 3.19	22.47 ± 3.88	0.242
FBS (mg/dL)	178.83 ± 72.81	194.29 ± 78.77	0.261
PPBS (mg/dL)	246.12 ± 85.21	254.42 ± 83.98	0.595

Among the 41 AITD patients, diffuse thyroid enlargement and nodular thyroid changes were the most common ultrasonographic findings, each observed in 16 (39.02%) patients. Hypoechoic thyroid echotexture was noted in 8 (19.51%) patients, while only 1 (2.44%) patient had a normal thyroid ultrasonography finding (Table 4).

Table 4: Thyroid Ultrasonography Findings Among AITD Patients (n = 41)

Ultrasonography Finding	Frequency	Percentage
Diffuse enlargement	16	39.02
Nodular changes	16	39.02
Hypoechoic thyroid	8	19.51
Normal study	1	2.44
Total	**41**	**100.0**

Chi-square analysis demonstrated statistically significant associations between AITD and female sex ($\chi^2 = 22.101$, $p < 0.0001$), hypothyroidism ($\chi^2 = 130.581$, $p < 0.0001$), and hyperthyroidism ($\chi^2 = 7.490$, $p = 0.0062$), indicating a strong relationship between thyroid dysfunction and autoimmune thyroid disease in T1DM patients (Table 5).

Table 5: Association Between AITD and Selected Categorical Variables Using Chi-square Test

Variable	Chi-square Value	Degrees of Freedom	p-value
Sex	22.101	1	<0.0001
Hypothyroidism	130.581	2	<0.0001
Hyperthyroidism	7.490	1	0.0062

Cross-tabulation analysis showed that all cases of hyperthyroidism were observed exclusively among AITD-positive patients. Of the 41 AITD-positive patients, 4 had hyperthyroidism, whereas none of the AITD-negative patients had hyperthyroidism (Table 6).

Table 6: Cross-tabulation of AITD Status and Hyperthyroidism

AITD Status	Hyperthyroidism Absent	Hyperthyroidism Present	Total
AITD Absent	109	0	109
AITD Present	37	4	41
Total	**146**	**4**	**150**

Anti-thyroid peroxidase (Anti-TPO) antibody positivity was observed in 37 hypothyroid patients, with a marked female predominance comprising 31 (83.8%) females and 6 (16.2%) males. Thyrotropin receptor antibody (TRAb) positivity was identified in all 4 hyperthyroid patients, with equal distribution between males and females (Table 7).

Table 7: Autoantibody Positivity According to Thyroid Disorder and Gender

Thyroid Disorder	Antibody Tested	Positive Cases	Female, n (%)	Male, n (%)
Hypothyroidism	Anti-TPO	37	31 (83.8)	6 (16.2)
Hyperthyroidism	TRAb	4	2 (50.0)	2 (50.0)

Logistic regression analysis did not identify any statistically significant independent predictors of autoimmune thyroid disease among T1DM patients. Variables including age, male sex, duration of diabetes, and BMI showed no significant association with AITD ($p > 0.05$ for all variables) (Table 8).

Table 8: Logistic Regression Analysis for Predictors of Autoimmune Thyroid Disease

Variable	Coefficient	Standard Error	z-value	p-value	95% CI
Constant	-7.918	11.281	-0.702	0.480	-30.03 to 14.19
Age	-0.835	0.660	-1.265	0.200	-2.128 to 0.458
Male Sex	-6.556	5.482	-1.196	0.230	-17.302 to 4.189
Duration of T1DM	1.325	1.032	1.284	0.190	-0.698 to 3.349
BMI	0.275	0.443	0.621	0.530	-0.593 to 1.143

Among high-risk autoimmune polyglandular syndrome (APS) patients, Anti-TPO positivity associated with hypothyroidism was predominantly observed in females, whereas TRAb positivity associated with hyperthyroidism showed equal gender distribution. These findings highlight the increased susceptibility of females to autoimmune thyroid involvement (Table 9).

Table 9: Autoantibody Positivity Among High-Risk APS Patients by Thyroid Disorder and Gender

Thyroid Disorder	Antibody Tested	Positive Cases	Female, n (%)	Male, n (%)
Hypothyroidism	Anti-TPO	37	31 (83.8)	6 (16.2)
Hyperthyroidism	TRAb	4	2 (50.0)	2 (50.0)

DISCUSSION

The present study demonstrated a considerable prevalence of autoimmune thyroid disease (AITD) among patients with Type 1 Diabetes Mellitus (T1DM), highlighting the close association between pancreatic and thyroid autoimmunity. The study population showed a nearly balanced gender distribution with 52% males and 48% females, which was comparable to the findings of Hwang et al., who reported 48% males and 52% females in their cohort [7]. However, Alhaj Hazzaa et al. reported a marked female predominance with 79% females and only 21% males [12]. The relatively balanced gender representation in the present study reduced gender-related bias and enabled better evaluation of sex-specific autoimmune trends. Female predominance among AITD-positive patients observed in the present study is consistent with the established higher susceptibility of females to autoimmune disorders due to hormonal and immunological factors.

In the present study, the mean BMI was 22.27 ± 3.70 kg/m², while fasting and postprandial glucose levels indicated poor glycemic control among the participants. Elevated thyroid stimulating hormone (TSH) levels and positive thyroid autoantibodies further supported the coexistence of thyroid autoimmunity in T1DM patients. Similar observations were reported by Hwang et al., who demonstrated elevated TSH levels among hypothyroid T1DM patients with thyroid autoantibody positivity [7]. Alhaj Hazzaa et al. also reported abnormal thyroid function among anti-TPO positive patients with T1DM, with most patients demonstrating HbA1c levels above 8% [12]. Poor glycaemic control may contribute to chronic inflammatory activation and immune dysregulation, thereby increasing susceptibility to autoimmune endocrinopathies. The present study additionally provided detailed biochemical parameters including BMI, glycaemic indices, and thyroid antibody profiles, enabling a more comprehensive assessment of metabolic and autoimmune interactions.

The prevalence of AITD in the present study was 27.33%, which is comparable with previous literature reporting increased thyroid autoimmunity among T1DM patients. Hwang et al. reported an AITD prevalence of 30.4%, while Alhaj Hazzaa et al. documented thyroid autoantibody positivity in 15.7% of patients [7,12]. Li et al., in a literature review, reported prevalence rates ranging between 21% and 30% among T1DM populations [4]. The variation in prevalence across studies may be attributed to differences in sample size, ethnicity, duration of diabetes, and diagnostic criteria used for defining AITD. In the present study, diagnosis was based on thyroid function tests, Anti-TPO antibodies, TRAb antibodies, and thyroid ultrasonography findings, thereby improving detection of both overt and subclinical disease. Hypothyroidism constituted the predominant thyroid dysfunction, whereas hyperthyroidism was comparatively less common. Significant associations between AITD and female sex, hypothyroidism, and hyperthyroidism further reinforce the strong autoimmune link between thyroid dysfunction and T1DM.

Thyroid ultrasonography in the present study revealed diffuse enlargement and nodular thyroid changes as the most common imaging findings among AITD-positive patients, followed by hypoechoic thyroid echotexture. Similar ultrasonographic abnormalities were described by Alhaj Hazzaa et al., who reported immune-pattern thyroid changes among anti-TPO positive patients [12]. Hwang et al. also emphasized the importance of thyroid ultrasonography as an early diagnostic tool in T1DM patients with suspected thyroid autoimmunity [7]. The present study additionally demonstrated

marked female predominance among Anti-TPO positive hypothyroid patients, supporting the established gender predisposition for autoimmune thyroid disease. Logistic regression analysis did not identify any statistically significant independent predictors of AITD, although duration of T1DM showed a weak positive trend. The absence of strong predictors suggests that thyroid autoimmunity in T1DM is multifactorial and may involve complex genetic, immunological, and environmental interactions. These findings support routine thyroid screening using biochemical and immunological markers in patients with T1DM for early diagnosis and prevention of long-term endocrine complications.

CONCLUSION

The present study demonstrated a high prevalence of autoimmune thyroid disease among patients with Type 1 Diabetes Mellitus, with hypothyroidism being the most common thyroid dysfunction. Female patients showed greater susceptibility to thyroid autoimmunity, and significant associations were observed between AITD and thyroid dysfunction. Although clinical parameters such as age, BMI, and duration of diabetes were not identified as independent predictors, the findings emphasize the importance of routine screening for thyroid function abnormalities and thyroid autoantibodies in patients with T1DM. Early identification of thyroid autoimmunity through biochemical and ultrasonographic evaluation may facilitate timely intervention, improve metabolic control, and reduce the risk of long-term endocrine complications in this high-risk population.

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