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Prevalence of Subclinical Hypothyroidism and Its Association with Dyslipidemia and Cardiovascular Risk Factors in Patients with Type 2 Diabetes Mellitus

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Abstract

Background: Type 2 Diabetes Mellitus (T2DM) is a common metabolic disorder associated with increased cardiovascular morbidity and mortality. Thyroid dysfunction, particularly subclinical hypothyroidism, frequently coexists with diabetes mellitus and may contribute to metabolic abnormalities, including dyslipidemia, insulin resistance, and increased cardiovascular risk. Subclinical hypothyroidism is characterized by elevated serum thyroid-stimulating hormone (TSH) levels with normal free thyroxine (FT4) concentrations. The association between subclinical hypothyroidism and cardiovascular risk factors among diabetic patients remains an important area of clinical investigation.

Materials and Methods: A prospective observational study was conducted among 121 patients with Type 2 Diabetes Mellitus attending the Department of Medicine. Patients were evaluated for demographic characteristics, duration of diabetes, body mass index (BMI), blood pressure, glycemic parameters, thyroid function tests, and lipid profile. Serum TSH and free thyroxine (FT4) levels were measured to identify subclinical hypothyroidism. Cardiovascular risk factors including hypertension, obesity, dyslipidemia, and duration of diabetes were assessed. Statistical analysis was performed using appropriate tests, and a p-value <0.05 was considered statistically significant.

Results: Among 121 patients with Type 2 Diabetes Mellitus, subclinical hypothyroidism was identified in a significant proportion of patients. Patients with subclinical hypothyroidism showed higher levels of total cholesterol, low-density lipoprotein cholesterol (LDL-C), and triglycerides compared with euthyroid diabetic patients. A significant association was observed between elevated TSH levels, dyslipidemia, increased BMI, hypertension, and longer duration of diabetes. Subclinical hypothyroidism was associated with an increased burden of cardiovascular risk factors.

Conclusion: Subclinical hypothyroidism is relatively common among patients with Type 2 Diabetes Mellitus and is significantly associated with dyslipidemia and cardiovascular risk factors. Routine thyroid function screening in diabetic patients may help identify high-risk individuals and allow early intervention to reduce cardiovascular complications.

Keywords: Type 2 Diabetes Mellitus, Subclinical Hypothyroidism, Thyroid Stimulating Hormone, Dyslipidemia, Cardiovascular Risk Factors, Lipid Profile

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Introduction

One of the most common chronic metabolic disorders in the world, type 2 diabetes mellitus (T2DM) poses a significant healthcare burden because of its rising incidence and related consequences. Persistent hyperglycemia brought on by insulin resistance, decreased insulin production, or both is its hallmark[1]. Long-term diabetes is linked to macrovascular problems like peripheral vascular disease, coronary artery disease, and stroke, as well as microvascular problems like nephropathy, neuropathy, and retinopathy.

For those with Type 2 Diabetes Mellitus, cardiovascular disease continues to be the predominant cause of morbidity and death. Hyperglycemia, hypertension, obesity, dyslipidemia, inflammation, and endothelial dysfunction all contribute to diabetes individuals' elevated cardiovascular risk. Improving cardiovascular outcomes in this population requires the identification of additional modifiable risk factors[2-4].

One of the most prevalent endocrine disorders linked to diabetes mellitus is thyroid dysfunction. Shared metabolic pathways, autoimmune processes, chronic inflammation, and hereditary predisposition may account for the coexistence of diabetes and thyroid problems. Patients with Type 2 Diabetes Mellitus often have subclinical hypothyroidism, one of the thyroid abnormalities.

An increase in serum thyroid-stimulating hormone (TSH) concentration with normal levels of free thyroxine (FT4) in the blood is known as subclinical hypothyroidism. Subclinical hypothyroidism can have major metabolic implications even though patients may not exhibit any clinical symptoms. Thyroid hormones are crucial for controlling heart function, vascular resistance, glucose homeostasis, and lipid metabolism.

By lowering hepatic LDL receptor activation, lowering cholesterol clearance, and changing triglyceride metabolism, thyroid hormone insufficiency can affect lipid metabolism. As a result, people with subclinical hypothyroidism may have higher levels of triglycerides, LDL cholesterol, and total cholesterol, which raises their risk of cardiovascular disease and atherosclerosis.

Dyslipidemia, which is characterized by elevated triglycerides, elevated LDL cholesterol, and decreased high-density lipoprotein cholesterol (HDL-C), is already more common in patients with Type 2 Diabetes Mellitus. Subclinical hypothyroidism may exacerbate this lipid profile and raise the risk of cardiovascular disease[5-8]. Subclinical hypothyroidism is more common in diabetes patients than in the general population, according to several studies. Thyroid dysfunction is more common in diabetics who are older, female, obese, have had diabetes for a longer period of time, and have poor glycemic control.

Because early detection and treatment may lessen long-term cardiovascular consequences, the association between subclinical hypothyroidism and cardiovascular risk factors is clinically significant. But the importance of minor thyroid dysfunction in diabetes patients is still up for debate, especially when it comes to how it affects lipid abnormalities and cardiovascular risk.

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In order to assess the prevalence of subclinical hypothyroidism and ascertain its correlation with dyslipidemia and cardiovascular risk factors in patients with Type 2 Diabetes Mellitus, this study was conducted[9].

Aim

To assess the prevalence of subclinical hypothyroidism and evaluate its association with dyslipidemia and cardiovascular risk factors in patients with Type 2 Diabetes Mellitus.

Objectives

1. To determine the prevalence of subclinical hypothyroidism among patients with Type 2 Diabetes Mellitus.
2. To compare lipid profile parameters between diabetic patients with subclinical hypothyroidism and euthyroid diabetic patients.
3. To evaluate the association between subclinical hypothyroidism and cardiovascular risk factors including hypertension, obesity, and duration of diabetes.
4. To assess the relationship between thyroid-stimulating hormone (TSH) levels and metabolic parameters such as HbA1c and lipid profile.

Materials and Methods

This was a prospective observational study conducted to evaluate the prevalence of subclinical hypothyroidism and its association with dyslipidemia and cardiovascular risk factors among patients with Type 2 Diabetes Mellitus.

The study was conducted in the Department of Medicine at a tertiary care hospital, the study was carried out over a period of 06 months. A total of 121 patients diagnosed with Type 2 Diabetes Mellitus attending the Medicine outpatient department and admitted to the medical wards were enrolled.

Inclusion Criteria:

Patients meeting the following criteria were included:

1. Patients diagnosed with Type 2 Diabetes Mellitus according to American Diabetes Association diagnostic criteria.
2. Age ≥30 years.
3. Patients willing to participate and provide written informed consent.
4. Patients with available thyroid function tests and lipid profile investigations.
5. Patients not receiving thyroid hormone replacement therapy or antithyroid medications.

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Exclusion Criteria:

Patients were excluded if they had:

1. Type 1 Diabetes Mellitus.
2. Gestational diabetes mellitus.
3. Previously diagnosed thyroid disorders on treatment.
4. Acute systemic illness or severe infection at the time of evaluation.
5. Chronic kidney disease stage 4 or 5.
6. Chronic liver disease.
7. Malignancy or systemic inflammatory disorders.
8. Patients unwilling to provide informed consent.

All enrolled patients underwent detailed clinical evaluation, laboratory investigations, and assessment of cardiovascular risk factors.

Clinical Assessment

A detailed history was recorded for all patients, including:

- Age
- Sex
- Duration of diabetes mellitus
- Family history of diabetes
- History of hypertension
- Current antidiabetic medications
- History of cardiovascular disease

Assessment of Glycemic Parameters

The following investigations were performed:

Venous blood samples were collected after overnight fasting for estimation of fasting glucose levels. HbA1c was measured to assess long-term glycemic control.

Patients were categorized as:

- Good glycemic control: HbA1c <7%
- Poor glycemic control: HbA1c ≥7%

Thyroid status was evaluated by measuring:

- Serum Thyroid Stimulating Hormone (TSH)
- Free Thyroxine (FT4)

Subclinical hypothyroidism was defined as:

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- Elevated serum TSH level above reference range
- Normal FT4 concentration
- Absence of overt clinical hypothyroid symptoms

Patients were divided into two groups:

Group A: Subclinical Hypothyroidism Group

Patients with elevated TSH and normal FT4.

Group B: Euthyroid Group

Statistical Analysis

Data were analyzed using appropriate statistical methods.

- Continuous variables were expressed as mean ± standard deviation.
- Categorical variables were presented as frequencies and percentages.
- Independent sample t-test was used for comparison of continuous variables.
- Chi-square test was used to analyze associations between categorical variables.
- Pearson correlation analysis was performed to determine the relationship between TSH levels and metabolic parameters.
- Logistic regression analysis was performed to identify independent predictors associated with subclinical hypothyroidism.
- A **p-value <0.05** was considered statistically significant.

Results

Table 1: Baseline Demographic and Clinical Characteristics of Study Participants (n=121)

Parameter	**Values**
Mean age (years)	57.2 ± 9.4
Male patients	70 (57.9%)
Female patients	51 (42.1%)
Mean duration of diabetes (years)	8.6 ± 4.5
Mean BMI (kg/m²)	27.8 ± 3.9
Hypertension present	61 (50.4%)
Poor glycemic control (HbA1c ≥7%)	82 (67.8%)
Mean HbA1c (%)	8.2 ± 1.5

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The study included 121 patients with Type 2 Diabetes Mellitus. The mean age was 57.2 years, with male predominance (57.9%). Approximately two-thirds of patients had poor glycemic control, and hypertension was present in half of the study population.

Table 2: Prevalence of Subclinical Hypothyroidism Among Patients with Type 2 Diabetes Mellitus (n=121)

Thyroid Status	**Number of Patients**	**Percentage (%)**
Euthyroid	89	73.6
Subclinical hypothyroidism	32	26.4
Total	121	100

Among the 121 patients with Type 2 Diabetes Mellitus, thyroid function assessment revealed that a considerable number of patients had abnormal thyroid parameters. Subclinical hypothyroidism was identified based on elevated serum TSH levels with normal FT4 concentrations.

Severity of Subclinical Hypothyroidism

TSH Level	**Number of Patients**	**Percentage (%)**
Mild elevation of TSH (4.5–10 mIU/L)	26	81.3
TSH >10 mIU/L with normal FT4	6	18.7
Total subclinical hypothyroidism cases	32	100

Subclinical hypothyroidism was observed in **26.4%** of patients with Type 2 Diabetes Mellitus. The majority of patients had mild elevation of TSH levels, whereas a smaller proportion had TSH levels above 10 mIU/L.

Table 3: Comparison of Glycemic and Lipid Profile Parameters Between Subclinical Hypothyroidism and Euthyroid Groups (n=121)

Parameter	**Subclinical Hypothyroidism Group (n=32) Mean ± SD**	**Euthyroid Group (n=89) Mean ± SD**	**p-value**
HbA1c (%)	8.7 ± 1.4	8.0 ± 1.5	0.021*
Fasting Blood Glucose (mg/dL)	176.8 ± 39.5	157.2 ± 36.7	0.014*
Total Cholesterol (mg/dL)	221.6 ± 38.4	194.5 ± 34.6	<0.001*

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Parameter	Subclinical Hypothyroidism Group (n=32) Mean ± SD	Euthyroid Group (n=89) Mean ± SD	p-value
LDL-C (mg/dL)	142.7 ± 31.2	118.4 ± 28.5	<0.001*
HDL-C (mg/dL)	38.6 ± 7.2	42.1 ± 8.1	0.034*
Triglycerides (mg/dL)	198.5 ± 52.6	164.8 ± 48.9	0.001*

*Statistically significant

Patients with subclinical hypothyroidism demonstrated significantly higher HbA1c, fasting blood glucose, total cholesterol, LDL-C, and triglyceride levels compared with euthyroid diabetic patients. HDL-C levels were significantly lower in the subclinical hypothyroidism group. These findings indicate an association between subclinical hypothyroidism and unfavorable metabolic profile.

Table 4: Association between Subclinical Hypothyroidism and Cardiovascular Risk Factors in Type 2 Diabetes Mellitus (n=121)

Cardiovascular Risk Factor	Subclinical Hypothyroidism (n=32)	Euthyroid Group (n=89)	p-value
Hypertension	22 (68.8%)	39 (43.8%)	0.017*
BMI ≥30 kg/m² (Obesity)	14 (43.8%)	19 (21.3%)	0.018*
Duration of diabetes >10 years	18 (56.3%)	25 (28.1%)	0.006*
Dyslipidemia	26 (81.3%)	42 (47.2%)	0.001*
History of cardiovascular disease	9 (28.1%)	11 (12.4%)	0.049*

*Statistically significant

Subclinical hypothyroidism was significantly associated with multiple cardiovascular risk factors. Patients with subclinical hypothyroidism had higher prevalence of hypertension, obesity, longer duration of diabetes, dyslipidemia, and cardiovascular disease compared with euthyroid patients.

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Table 5: Correlation of Serum TSH Levels with Glycemic and Lipid Parameters

Parameter	Correlation Coefficient (r)	p-value
HbA1c	+0.31	0.001
Fasting Blood Glucose	+0.28	0.002
Total Cholesterol	+0.42	<0.001
LDL-C	+0.45	<0.001
Triglycerides	+0.36	<0.001
HDL-C	-0.24	0.008

Serum TSH levels showed a significant positive correlation with HbA1c, fasting blood glucose, total cholesterol, LDL-C, and triglycerides. A negative correlation was observed between TSH and HDL-C levels, suggesting that increasing thyroid dysfunction is associated with worsening metabolic and cardiovascular risk profiles.

Discussion

Among 121 patients with Type 2 Diabetes Mellitus, the current prospective observational study assessed the prevalence of subclinical hypothyroidism and its correlation with dyslipidemia and cardiovascular risk factors. The study showed that subclinical hypothyroidism was a common endocrine problem in diabetes patients and that it was strongly linked to a poor lipid profile and a higher risk of cardiovascular disease[10].

In this study, 26.4% of patients with Type 2 Diabetes Mellitus had subclinical hypothyroidism. This result is in line with other research showing that thyroid dysfunction is more common in diabetes populations than in the general population. Shared risk factors such as obesity, insulin resistance, chronic inflammation, autoimmune processes, and metabolic disorders may be responsible for the increased incidence of subclinical hypothyroidism in diabetes patients[11-13].

Even minor thyroid hormone imbalances can affect a number of metabolic processes, but subclinical hypothyroidism is frequently asymptomatic. Through their effects on hepatic cholesterol production, LDL receptor expression, and circulating lipoprotein clearance, thyroid hormones control lipid metabolism. Decreased LDL receptor function from decreased thyroid hormone activity may result in impaired LDL clearance and elevated blood cholesterol levels.

The subclinical hypothyroidism group's mean total cholesterol levels were substantially higher than those of euthyroid patients in the current study (221.6 ± 38.4 mg/dL vs. 194.5 ± 34.6 mg/dL; $p<0.001$). Additionally, there was a substantial rise in LDL cholesterol (142.7 ± 31.2 mg/dL vs. 118.4 ± 28.5 mg/dL; $p<0.001$). These results imply that even minor thyroid

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dysfunction may exacerbate dyslipidemia in individuals with diabetes mellitus who are already at heightened cardiovascular risk[14].

Additionally, the current investigation showed a strong correlation between poor glycemic control and subclinical hypothyroidism. The mean HbA1c values of patients with subclinical hypothyroidism were greater than those of euthyroid patients (8.7 ± 1.4% vs. 8.0 ± 1.5%; p=0.021). Through lower insulin sensitivity, decreased peripheral tissue absorption of glucose, and changes in insulin secretion, thyroid hormone insufficiency may lead to impaired glucose metabolism.

The relationship between subclinical hypothyroidism and cardiovascular risk factors was also evaluated. In this study, the prevalence of hypertension was substantially higher in individuals with subclinical hypothyroidism than in those with euthyroid diabetes (68.8% vs. 43.8%; p=0.017). The correlation between hypothyroidism and hypertension may be explained by increased vascular resistance, arterial stiffness, and decreased endothelial function caused by thyroid hormone deficiency.

Patients with subclinical hypothyroidism were more likely to be obese. The group with subclinical hypothyroidism had a substantially greater prevalence of BMI ≥30 kg/m² (43.8% vs. 21.3%; p=0.018). Thyroid dysfunction may further encourage weight gain by lowering basal metabolic rate, whereas obesity and insulin resistance may contribute to changes in thyroid hormone metabolism.

Patients with subclinical hypothyroidism had higher rates of cardiovascular disease (28.1% vs. 12.4%; p=0.049). Larger prospective studies are needed to determine if subclinical hypothyroidism independently predicts cardiovascular events in diabetes patients, even though the link was statistically significant[15-16].

The findings of this study emphasize the importance of thyroid screening in patients with Type 2 Diabetes Mellitus, particularly those with poor glycemic control, dyslipidemia, obesity, or cardiovascular risk factors. Early identification of subclinical hypothyroidism may help clinicians implement appropriate monitoring and management strategies to reduce cardiovascular complications.

Conclusion

Subclinical hypothyroidism is a common endocrine abnormality among patients with Type 2 Diabetes Mellitus. In the present study, more than one-fourth of diabetic patients had subclinical hypothyroidism. Patients with subclinical hypothyroidism demonstrated significantly higher levels of total cholesterol, LDL cholesterol, triglycerides, and HbA1c compared with euthyroid diabetic patients. Furthermore, subclinical hypothyroidism was significantly associated with hypertension, obesity, longer duration of diabetes, dyslipidemia, and cardiovascular disease.

Routine screening of thyroid function, particularly serum TSH measurement, may be beneficial in patients with Type 2 Diabetes Mellitus, especially those with poor metabolic control or increased cardiovascular risk. Early recognition and appropriate management of

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thyroid abnormalities may contribute to improved metabolic outcomes and reduction of cardiovascular complications.

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