

Association of thyroid disorders in patient with Diabetes mellitus, hospital based, single centric cross sectional study

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Introduction

Diabetes mellitus is a common metabolic disease characterized by presence of hyperglycemia due to defects in insulin secretion, insulin action, or both. Type 1 and type 2 are major types and separate pathophysiology has contributed to their causation.¹

Type 2 diabetes mellitus (DM) is a growing problem in south east Asian countries and many of the patients are associated with thyroid dysfunction later in their life, however, the prevalence of thyroid dysfunction in these patients has not been investigated.²

Incidence of diabetes patients is increasing in Nepal. This can be understood from the respective prevalence, in the years 2010-2015 and 2015-2020, was 7.75% and 11.24% on an average.³

Insulin and thyroid hormones are intimately involved in cellular metabolism. The physiological and biochemical interrelationship between insulin and the influence of both insulin and iodothyronines on the metabolism of carbohydrates, proteins and lipids are recorded. Iodothyronines are insulin antagonist with high levels being diabetogenic while absence of the hormone inhibits the development of diabetes.⁴ Thyroid hormone in adult controls the metabolism within the body.⁵

Abstract

Background: Diabetes and thyroid dysfunctions are globally increasing common health problem. Both of these problems are metabolically related to each other. Early screening of thyroid disorders in diabetic patient helps in diagnosis and identification of the disease and its complication for better management. Hyperthyroidism and thyrotoxicosis can worsen Diabetes mellitus and cause hyperglycemia and poor Blood sugar control. So we have conducted this study to find the association of Diabetes mellitus and Thyroid disorders in our part of the country.

Methods: It was a hospital based descriptive cross sectional study which was conducted among 180 patients in Pokhara academy of health sciences Pokhara from Nov 2023 to October 2024. Ethical clearance was taken from Institutional review committee. Diabetic patients were evaluated for thyroid dysfunction. Demographic profile, Diabetic status and thyroid function test was carried out. Results were analyzed using SPSS 21 version.

Results: A total of 180 patients enrolled in the study 41.1% (n=74) were male, while 58.9% (n=106) were female. Thyroid stimulating Hormone (TSH) levels have a weak but statistically significant positive correlation with diabetes parameters, (FBS: $r=0.223$, $p=0.003$) (PPBS: $r=0.168$, $p=0.024$) (HbA1c: $r=0.218$, $p=0.003$), implying that higher TSH levels indicative of hypothyroid was associated with poorer glucose control.

Conclusion: Thyroid disorders are more commonly associated with diabetes mellitus. Early screening of thyroid disorder in Diabetic is beneficial for the patient.

The earliest biochemical abnormality in hypothyroidism spectrum is an increase in serum thyroid-stimulating hormone (thyrotrophin) (TSH) concentration associated with normal serum free thyroxine (T4) and triiodothyronine (T3) concentrations (subclinical hypothyroidism), followed by a decrease in serum free T4 concentration, at which stage, most patients have symptoms and benefit from treatment (overt hypothyroidism).⁶

The overproduction of hormones by the thyroid gland causes the body to consume energy at a higher rate than at normal while the underproduction causes the body to consume less energy and at a lower rate.¹⁰ Though thyroid and associated problems are common in all ages, females with increasing age are more prone to thyroid associated diseases.⁷⁻⁸

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Since the prevalence of these two metabolic disorders is common in our part of the country the aim of the study was to find the association of Thyroid disorders in Diabetes patient.

Methodology

This is a hospital based cross sectional observational study which was conducted among 180 cases of who have visited in the OPD and admitted in IPD of Pokhara Academy of Health Sciences (PoAHS) from November 2023 to September 2024. Prior to the study ethical approval was taken from institution review board (IRB) with reference no 203/080. Sample size was calculated from $n = Z^2 \times (p \times q) / e^2$. N = Sample size. Z = Desired reliability (1.96 for 95% CI) P = Estimated incidence (14.7% . 17) , q = 100- p . e = Maximum tolerable error (5%), N =180. Written consent was taken from all of the patients prior to the enrollment. Brief history and physical examination were carried out in all of the patients who fulfill the inclusion criteria.

Inclusion Criteria was any Patient diagnosed with thyroid disorders including both hypothyroidism and hyperthyroidism were considered for the study.

Exclusion Criteria Were patient undergoing thyroidectomy, Patients suffering from other chronic diseases and Pregnancy induced gestational diabetes were excluded. Relevant investigation was performed (Thyroid function tests, fasting blood glucose level ,2 hr post prandial blood glucose level and HbA1c). The collected data were entered and coded in Microsoft excel 2010 and exported to statistical packages for the social studies (SPSS) version 23 for statistical analysis. The frequency, percentages and mean (SD) were calculated. P value of <0.05 were consider as statistically significant.

Results

The table presents the sociodemographic characteristics of the patients, including gender distribution, religious affiliation, and age statistics. Among the 180 patients, 41.1% ($n=74$) were male, while 58.9% ($n=106$) were female. Regarding religious affiliation, 21.1% ($n=38$) identified as Buddhist, whereas 78.9% ($n=142$) identified as Hindu. The mean age of the patients was 58 years, with a standard deviation of 12.6 years.

Sociodemographic Characteristics of the patients		
Variables	Number	Percentage
Gender		
Male	74	41.1
Female	106	58.9
Religion		
Buddhist	38	21.1
Hindu	142	78.9
Age (Mean,SD)	58 +12.6	

The table presents the mean and standard deviation (SD) values for diabetes-related and thyroid function parameters among the study participants. The fasting blood sugar (FBS) level had a mean of 135.81 mg/dL with an SD of 59.41, while the postprandial blood

sugar (PPBS) level had a mean of 203.87 mg/dL and an SD of 108.63. The glycated hemoglobin (HbA1C) level had a mean of 7.11% with an SD of 1.87.

Regarding thyroid function parameters, the mean free triiodothyronine (FT3) level was 3.4 pg/mL with an SD of 1.64, while the mean free thyroxine (FT4) level was 10.14 pg/mL with an SD of 5.93. The mean thyroid-stimulating hormone (TSH) level was 5.25 μ IU/mL, with an SD of 11.74.

Variables	Mean	SD
FBS	135.81	59.41
PPBS	203.87	108.63
HBA1C	7.11	1.87
FT3	3.4	1.64
FT4	10.14	5.93
TSH	5.25	11.74

Data in the table suggest that TSH levels have a weak but statistically significant positive correlation with diabetes parameters, (FBS: $r=0.223$, $p=0.003$) (PPBS: $r=0.168$, $p=0.024$) (HbA1c: $r=0.218$, $p=0.003$), implying that higher TSH levels (indicative of hypothyroidism) may be associated with poorer glucose control. However, the correlations between FT3, FT4, and diabetes parameters are not statistically significant, suggesting that these thyroid hormones may not have a strong direct relationship with glucose metabolism in this patient population. The findings highlight the potential importance of monitoring thyroid function, particularly TSH levels, in patients with diabetes to ensure comprehensive management of their metabolic health.

Correlation between Diabetes parameters and Thyroid Function parameters						
	FBS	PPBS	HBA1C	FT3	FT4	TSH
FBS	1	0.887 (<0.001)	0.865 (<0.001)	-0.106 (0.156)	-0.047 (0.530)	0.223 (0.003)
PPBS		1	0.806 (<0.001)	-0.086 (0.253)	0.008 (0.918)	0.168 (0.024)
HBA1C			1	-0.142 (0.058)	-0.078 (0.301)	0.218 (0.003)
FT3				1	0.780 (<0.001)	-0.124 (0.097)
FT4					1	-0.154 (0.039)
TSH						1

Discussion

Diabetes mellitus and Thyroid disorders both are common metabolic problem and they are diagnosed late and sometimes we often diagnosed them after they develop complications. Early diagnosis and treatment helps in disease treatment and complication management. Most of the patient presented to our hospital have similar profile and clinical presentation with few of the common risk factors so early diagnosis helps in disease identification in specific population and prevention of complication.

Genetic factors and autoimmunity might contribute the co-occurrence of Type 1 diabetes mellitus and Thyroid disorders. Autoimmune Thyroid disorder (AITD) occurs in 17% to 30% of adults with T1DM. T1DM and AITD are both organ-specific T cell-mediated diseases. Similarly the prevalence of hypothyroidism in T2DM ranges from 6% to 20% in epidemiologic studies across different ethnic groups.⁹ In a study done by Laloo Demitrost, Salam Ranabir Department of Medicine, Regional Institute of Medical Sciences, Imphal, Manipur, India. out of the 202 type 2 DM patients included in the study, 61 are males and 141 are females. The mean duration of type 2 DM is 62 months (just more than 5 years). It is found that 139 (68.8%) are euthyroid, 33 (16.3%) have subclinical hypothyroidism, 23 (11.4%) have clinical hypothyroidism, 4 (2%) have subclinical hyperthyroidism and 3 (1.5%) are hyperthyroidism cases. This study showed a high prevalence of thyroid dysfunction in type 2 DM (31.2%).¹⁰

Similar study done Vibha Uppal, Chittranjan Vij et al in India in 2012 in North Indian population and to correlate the serum insulin and glycosylated hemoglobin levels with thyroid hormones shows Fasting blood glucose and glycosylated hemoglobin levels were significantly higher in diabetics showing a poor glucose control. There was a significant correlation between glycosylated hemoglobin and thyroid hormones. There was a significant negative correlation between glycosylated hemoglobin and serum T3 levels ($r = -0.338, p = 0.016$) and between glycosylated hemoglobin and serum T4 levels ($r = -0.390, p = 0.005$).¹¹ Study done by Vadivelan Mehalingam, Jayaprakash Sahoo et al in Indian population shows the prevalence of thyroid dysfunction among diabetic patients was 17.5% in this study. Hypothyroidism was more common in the study subjects as compared to hyperthyroidism.¹²

Prevalence of thyroid disorders among T2DM patient is significantly higher ranging from 9.9 to 48%. TD is more common among T1DM than T2DM. International guidelines vary widely and do not specifically suggest routine screening for this milder form of TD in T2DM patients. Coexistent T2DM and TD pose a higher cardiovascular disease risk. Insulin resistance links these conditions. TD can worsen T2DM and diabetes can worsen thyroid function. Considering the clinical implications of the coexistence of T2DM and TD, a more systematic approach to thyroid testing in T2DM is needed.¹³ Similarly a cross sectional study by Saroj khatiwoda, Rajendra KC et al in B.P Koirala Institute of Health Sciences shows that Thyroid dysfunction was much common in females (42.85%) compared to males (30.04%) ($p = 0.008$) and in type 1 diabetes (50%) compared to type 2 diabetes mellitus (35.41%) ($p = 0.218$). Diabetic patients with thyroid dysfunction had higher total cholesterol, HDL cholesterol, and LDL cholesterol in comparison to patients without thyroid dysfunction.¹⁴⁻¹⁵

Conclusion

Prevalence of thyroid disorders is seen more among diabetes patient than in general population. Many studies have shown that significant proportion of the diabetes patient have subclinical and clinical forms of Thyroid disorder so regular monitoring of the Thyroid functions during glycemic status monitoring would be beneficial to the patient.

Conflict of interest:

None

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