



DIABETES MELLITUS AND THYROID DYSFUNCTION: A DOUBLE EDGED SWORD.

Biochemistry

Dr. Sadaf Ali	Senior Resident, Department of Biochemistry, Faculty of Medicine, Government Medical College, Srinagar.
Dr. Nivedita L Rao	Professor, Department of Biochemistry, Faculty of Medicine, Yenepoya Medical College and Hospital Yenepoya University, Deralakatte, Mangalore, India.
Dr. Shiekh Amir*	Senior Resident, Department of Forensic Medicine, Faculty of Medicine, Government Medical College, Srinagar. *Corresponding Author

ABSTRACT

Interlinking mechanism of thyroid disorders in diabetes mellitus has been suggested by various studies. Inter-connections at the molecular level such as the common signalling pathways explain the linkage. Untreated and undiagnosed thyroid disorders may affect insulin sensitivity and resistance thereby hampering glycaemic control in diabetic patients. Aims and objectives: To know thyroid functioning and spectrum of dysfunctions in type 2 diabetic patients. Materials and methods: Serum samples were obtained from 95 diabetic patients of both genders. Patients who visited the Department of Medicine of Yenepoya Hospital for treatment were taken for the purpose of this study. Some of the patients were on treatment with oral hypoglycaemic drugs and some on insulin or both. Patients were divided into two groups based on duration of disease. Levels of T3, T4 and TSH were measured in all the patient samples using VITROS 5600 analyser. Results: In our study population hypothyroidism was more common in diabetic females when compared to the diabetic male subjects. Similar results were seen in sub-clinical hypothyroidism; which was more commonly found in female patients. Possible reason for this may be attributed to hormonal imbalance in women.

KEYWORDS

Thyroid, hypothyroidism, diabetic patients.

INTRODUCTION:

The two most common endocrine disorders that come across during clinical practice are thyroid disorders and diabetes mellitus. Different types of thyroid abnormalities are associated with diabetes mellitus. There are many studies suggestive of conflicting findings between thyroid dysfunction in diabetic patients. According to some studies, the prevalence of thyroid dysfunction among type two diabetic patients was very high about 30% with sub clinical hypothyroidism being most common.^{3,4} Other studies done in different populations suggested thyroid dysfunction as a common complication in diabetic patients attributed mainly to complex interlinking biochemical, genetic, and hormonal malfunctions that reflects this pathophysiological association.⁵ Thyroid gland is located immediately below the larynx on each side, anterior to the trachea in our body. It is one of the largest endocrine glands weighing about 15 to 20 grams in adults. Thyroid gland mainly secretes two major hormones, thyroxine and tri-iodothyronine (commonly called T4 and T3). Both of these hormones profoundly affect metabolic rate of the body. Secretion of thyroid hormones in the circulation is mainly controlled by levels of thyroid stimulating hormone (TSH). TSH is formed by anterior pituitary gland. Thyroxine forms about 93% and tri iodothyronine forms 7% of the metabolically active thyroid hormones. Thyroxine is eventually converted to tri iodothyronine and is about four times as potent as thyroxine. In the blood however, it is present in smaller quantities and persists for a much shorter time than thyroxine.²

Thyroid hormones mainly regulate pancreatic function and carbohydrate metabolism while as diabetes mellitus leads to changes in normal thyroid functioning.¹⁷ Variations in Hypothalamic-pituitary-thyroid axis also produce significant metabolic disturbances. Thyroid function is influenced by diabetes mellitus at the level of hypothalamic control of TSH release and at tissue level; where conversion of T4 to T3 takes place. Hyperglycemias reduce hepatic concentration of enzymes like T4-5 de-iodinase, decrease serum concentration of T3, and raised levels of reverse T3 and low, normal, or high level of T⁴.

The overall prevalence of thyroid dysfunction among type 2 DM patients is relatively higher on many occasions. Diabetic patients should be consequently screened for thyroid dysfunction in order to reduce the mortality rate.⁵⁻⁸ Defective insulin secretion leads to various metabolic changes in T2DM, varying from hyperglycaemia to dyslipidemias. Former is due to defective insulin-stimulated uptake of glucose and up regulated hepatic glucose production and later attributed to impaired homeostasis of fatty acids and accumulation of

triglyceride's and lipoproteins.^{3, 5} Hence, routine screening for thyroid dysfunction is suggested in diabetic patients, which will help in early diagnosis and treatment thereby improving their quality of life and eventually reduction in the morbidity rate.^{3,4}

Materials and methods:

Diabetic patients in the age group of 30 to 60 years who attended Yenepoya Hospital participated for the purpose of this study. Type 2 diabetic patients were considered for the purpose of this study. Permission was granted for conducting this study from the Institutional Ethical Committee. Informed written consent was taken from every patient. A Cross sectional study was carried. Blood samples from 95 diabetic patients both male and female attending the Department of Medicine of Yenepoya Medical College and Hospital were obtained. Patients were grouped into two: Group 1 consisted of patients who had less than ten years of duration of diabetes mellitus and group 2 consisted of patients with more than ten years of type 2 DM. Fasting venous blood samples were collected from OPD patients as well as from the admitted patients. Exclusion and inclusion criteria were fulfilled from each patient. Patients having cardiac failure, pulmonary diseases, renal failure, cancer and alcoholism were excluded from the study.

Clinical and Biochemical measurements:

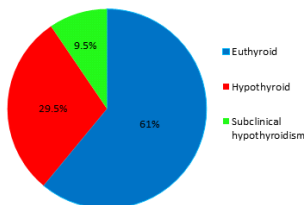
Fasting blood sample was obtained from each patient with all aseptic precautions and the following parameters were measured: T3, T4, TSH, and FBS. The VITROS GLU slide method was performed on VITROS 250/350/950 and 5, 1 FS Chemistry systems and the VITROS 5600 integrated system for the estimation of blood sugar. A competitive immunoassay technique using the VITROS 5600 Integrated System (intellicheck technology) was used for measuring the levels of T3, T4 and TSH. The bound HRP conjugate was measured by a luminescent reaction.

Results and Discussion:

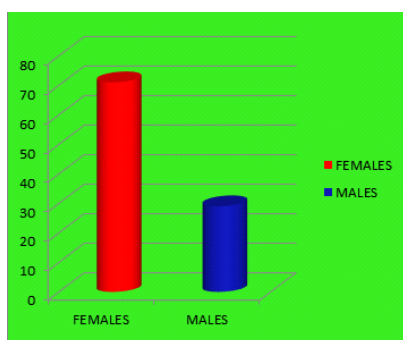
Table 1. Thyroid status in diabetic study groups:

		Thyroid status			Total	p value
		Euthyroid	Hypothyroid	Sub clinical hypothyroidism		
Group 1 DM duration <10 years	N	27	14	5	46	.944

	%	58.7%	30.4%	10.8%	100
Group 2	N	31	14	4	49
DM	%	63.3%	28.6%	8.2%	100
duration					%
>10 years					
Total	N	58	28	4	95
	%	61.1%	29.5%	4.2%	100
					%



Graph 1: Prevalence of thyroid disorders in diabetes mellitus.



Graph 2: Prevalence of hypothyroidism in male and female diabetic patients

There were varying results of diabetes mellitus with respect to thyroid profile in the present study. Although thyroid disorders are prevalent in diabetes mellitus, there are variations due to differences in geographical distribution and type of population as shown in Table 1. In our study population hypothyroidism was more common in diabetic females when compared to diabetic males as depicted from Graph 2. Same was true for sub-clinical hypothyroidism which was also more common in females. Possible reason for this may be attributed to hormonal imbalance in women during menstruation and also pregnancy that can further enhance the inflammatory process on thyroid gland increasing the tendency towards hypothyroidism as suggested by literature. These results are similar to the study results of Ashok Khurana (2016) where there was a high prevalence of thyroid disorders in DM and sub-clinical hypothyroidism was more in females and uncontrolled diabetes mellitus. Venkateshwarlu Nandyal (2013), Penugonda (2015) also studied about diabetes mellitus and thyroid disorders and got similar results like our study.

DISCUSSION:

Thyroid disorders are second most common endocrine dysfunctions. Thyroid dysfunction may amplify cardiovascular disease risk in diabetic patients though inter-relationships with dyslipidemia, insulin resistance, and vascular endothelial dysfunction. It is important to diagnose thyroid dysfunction in diabetes mellitus patients and this practice should be encouraged in clinical settings. This would encourage further understanding of the relationship between thyroid function and diabetes, thereby reducing morbidity and mortality from these conditions. 8, 16 Thyroid dysfunctions complicate management of diabetes mellitus and its complications. Thyroid function tests should be estimated at least once in a year for patients with diabetes mellitus as a variety of thyroid abnormalities may co-exist with diabetes mellitus.⁹ Some studies suggest that there is altered thyroid profile and increased serum cholesterol which further aggravates risk of atheroma in diabetic patients, thereby emphasizing screening of diabetic patients for thyroid disorders. Thus, this may be helpful for early treatment as thyroxine replacement will reverse the dyslipidemia and further decreases the risk of cardio vascular diseases.^{10,6,7}

Additionally an assessment of TSH status may have wide-ranging clinical significance in the management of hypercholesterolemia in both diabetic and non-diabetic individuals.⁶ Detection of abnormal thyroid hormone levels in the early stage of DM may help patients improve the quality of life and reduce the morbidity rate. 12 A high prevalence of Thyroid dysfunction was observed in type 2 Diabetes mellitus patients as compared to non-diabetic population with hypothyroidism and clinical thyroid disorders being more common than hyperthyroidism and sub-clinical thyroid disease. Thus, one must have strong suspicion of thyroid dysfunction in patients with diabetes mellitus.¹⁵

CONCLUSION:

Diabetes mellitus co-exists with thyroid disorders and both influence each other mutually therefore, screening of thyroid dysfunction in all diabetic patients – especially in patients with poor diabetic control should be performed. Screening of type two diabetic patients for thyroid disorders may prove helpful in reduction of complications induced by insulin resistance, improve quality of life and reduce the morbidity rates. Routine assessment of thyroid hormone level in addition to other biochemical parameters in the early stage of diabetes will help in the better management of such patients.

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