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Thyroid Disease andDiabetes

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Abstract*This study was carried out to estimate thyroid hormones (T3, T4 and TSH) level in diabetic patients and to compare it with normal controls in an attempt to find out the importance of thyroid hormone estimation in diabetic cases. Fifty cases of diabetes mellitus who attended Diabetic Clinic, J.L.N.M.CH , Bhagalpur during the period from October 2016 to March 2017 were taken as the cases and 50 healthy individuals were selected as control group. Serum total Tri-iodothyronine (T3), Thyroxine (T4), Thyroid stimulating hormone and blood sugar were estimated in both the cases and controls. The study showed that diabetes was more prevalent in the age group of 51-65 years, and more in males (52%). The mean fasting blood sugar (182.12 ± 30.28mg%) and serum TSH level (8.54 ± 1.07mIU/L) were increased significantly (r=0.884, p>0.05) whereas serum T4 level (2.21± 0.55µg/dl) was decreased in diabetic cases when compared with controls.Mean T3 level of diabetic cases was higher than controls but it was insignificant. Diabetes mellitus cases with statistically significant higher TSH value have more prevalence of complications like hypertension, retinopathy, nephropathy etc. A statistically significant, negative correlation (r=-0.942, p<0.05) was seen between Serum T4 and blood sugar in the cases.Therefore routine screening of thyroid hormone level in addition to other biochemical tests in the early stage of diabetes will help better in the management of thease patients.*

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I. Introduction

Thyroid diseases and Diabetes mellitus are the two most common endocrine disorders encountered routinely in daily clinical practice. Diabetes and thyroid disorders have been shown to mutually influence each other and associations between both conditions have long been reported.(1) On one side, thyroid hormones contribute to the regulation of carbohydrate metabolism and pancreatic function, and on the other hand, diabetes affects thyroid function tests to variable extents.(2) This paper may help to understand the importance of recognition of this inter dependent relationship between Thyroid disease and Diabetes which in turn will help clinicians for the optimal screening and management of these conditions.

Diabetic patients have a higher prevalence of thyroid disorders compared to the normal population. The prevalence of thyroid dysfunction in DM varies from 6.6% to 13.4% with majority of hypothyroidism (around 30%) and subclinical hypothyroidism (around 50%).(3)(4) A number of studies have also found a higher prevalence of thyroid disorders in type 2 diabetic patients, with hypothyroidism being the most common disorder.

II. Material Methods

It This study was a cross sectional study,conducted in the Department of Biochemistry in association with the Department of Medicine, J.L.N.M.C.H Bhagalpur, during the period from October 2016 to March 2017.The Study Group consisted of 86 confirmed diabetic cases on Oral Hypoglycemic agent or insulin or Diabetic diet attending Diabetic Clinic, J.L.N.M.CH Bhagalpur. Controls consisted of 50 age and sex matched healthy individuals. Those cases with previously diagnosed thyroid disorders, history of other chronic illness, Hyperlipedemia, physiological stress which induce alteration in thyroid hormones were excluded from this study. Detailed history of each patients regarding age, sex, address, religion, occupation, marital status, personal history,duration of diabetes and treatment history was taken in proper performa. Informed consent of the patient was recorded in a performa designed for this study. Approval for this study was taken from the ethical committee.

Fasting as well as post-prandial blood sugar was measured to know the glycemic status of patients.A total of 6 ml of venous blood from anticubital vein was collected after overnight fasting. Two ml of blood was sent in fluoride vial for estimation of fasting blood glucose,2 ml in plain vial for thyroid hormone, cholesterol estimation. Another 2 ml was sent for HBA1c estimation in heparanized vial. It was centrifuged at 4000 rpm for

separation of serum. For estimation of post prandial blood glucose level, 2 ml of venous blood ,2 hours after the patients's regular meal, was collected again in fluoride vial.

Blood glucose was estimated by Glucose oxidase-peroxidase Method as described by Trindler P using commercially available kit, Human GmbH, Germany.(5) TSH was measured by classical sandwich Enzyme Linked Immunosorbant Assay (ELISA) technique(6). T3 and T4 were estimated by using competitive binding ELISA technique.

HbA1c was estimated by the method of Trivelli et al 1979.(7) Serum cholesterol was estimated by the method of CHOD-POD.(8)Interpretation of the result was based on the following criteria.(9)

- Normal, when the total T4 and TSH are in the normal range (i.e., TSH=-0.69-2.02 ng/ml; T4=4.4-10 µg/dl for males and 4.8-11.6 µg/dl for females).

- Hypothyroidism-when total T4<4.4 µg/dl and TSH>6.2 mI U/l.
- Subclinical hypothyroidism when T4 is within normal limits but TSH>6.2 mIU/l.
- Hyperthyroidism when serum TSH<0.3 mIU/l.

III. Statistical Analysis

Data are expressed as Mean ± SD and percentage. Continuous variables of the 2 groups were compared by student's t test wherever suitable. These statistical analyses were performed using SPSS version 16.

IV. Result And Discussion

In this study the diagnosis criteria of Diabetes Mellitus was based on World Health Organisation (WHO) 2005, Diabetes was diagnosed on the basis of the fasting plasma glucose ≥ 126 mg/dl or HBA1c >6.5%.(10) The symptoms of DM varies person to person and may be polyuria, polydypsia, polyphagia and weight loss. The long term complications of DM includes, neuropathy, nephropathy, retinopathy, angiopathy, and increase susceptibility to infection,depending on duration and sugar control in disease patients.(11) 90 patients previously diagnosed as DM were included in this study for assessment of thyroid status out of this 50 cases demonstrated are high serum TSH and low T3 and T4 level. In this 50 cases serum cholesterol level was estimated do detect any abnormality.

In this study the mean fasting plasma glucose level was significantly increased in cases when compared with control this rise is statistically significant (p<0.001;).

Changed FBS concentration in control and cases:

	Control (n=50)	Cases (n= 50)	p value
FBS (mg/dl)	88.20±6.08	182.12 ± 30.28	< 0.001

This raise of blood glucose is may be due to impaired insulin secretion, insulin resistance, or increased glucose production resulting from environmental and genetic factors in diabetes mellitus.(12)

The mean HbA1c level was significantly increased in cases when compared with control this was statistically significant (p<0.001).

Table2:-HBA1c Level

	Control (n=50)	**Cases (n= 50)**	**p value**
HbA1c (%)	**5.02±0.52**	**8.01±0.28**	**< 0.001**

Glycated haemoglobin usually indicates the long term blood sugar status in Diabetes patients. Free amino groups of haemoglobin reacts with glucose by non-enzymatically reaction and form covalent glycated haemoglobin. There are different glycatedderivates are existed and these are collectively called as HbA1. The important constituent of HbA1 is HbA1c, formed with glucose.(13) It contains around 5% of circulating haemoglobin (14). HbA1c reflects the average value of blood glucose over the past three months.

The mean serum T3 and T4 levels are significantly decreased in cases when compared with control and this decrease is statistically significant (p<0.001)(Table 3). But the mean serum TSH level was significantly increased in cases when compared with control (p<0.001)(Table 3).

Table 3: Comparison of Thyroid profile in control and cases:

	Control (n=50)	Cases (n= 50)	p value
T3 (ng/dl)	101.24 ± 10.31	71.80 ± 12.25	< 0.001
T4(µg/dl)	8.01± 1.22	2.21± 0.55	< 0.001
TSH(mIU/ml)	2.42± 0.54	8.54 ± 1.07	< 0.001

Diabetic group patients have a higher prevalence of thyroid dysfunction compared with the normal healthy individuals. A number of studies have also indicated a higher than normal prevalence of thyroid dysfunction in type 2 diabetic patients, with hypothyroidism being the most common.Udiong,A et al., (2007) studies shown that 46.5% of diabetics mellitus have altered thyroid hormone levels 26% of the diabeticshave low levels of thyroid hormone and 19.9%.had raised levels.(15) Guang-Ran Yang et al., (2010) studies shown that 22.4% of diabetes mellitus with type 2 have subclinical hypothyroidism.(16) The hypothyroidism in diabetic patients may be due to any one of the following reason -

- The presence of anti thyroid peroxidase antibodies or thyroid autoantibodies .(17)
- Serum T_3 low,due to reduced peripheral conversion of T_4 to T_3 via 5' monodeiodination reaction.
- Poorly controlled diabetes may also causes impaired TSH response to TRH or loss of normal nocturnal TSH peak.

The deranged thyroid hormone levels found in diabetes is due to the presence of thyroid hormone binding inhibitor (THBI), an inhibitor of extra thyroidal conversion enzyme (5'-deiodinase) of T_4 to T_3, and dysfunction of the hypothalamo-pituitary-thyroid axis. The major abnormality in thyroid hormone system are reduction in the TSH stimulation of the thyroid gland, probably caused by central hypothyroidism, and in the peripheral conversation o T_4 to T_3. The TPO antibodies is associated with an increased risk of Hypothyroidism.

Patients having TPO antibodies are more likely to develop hypothyroidism rather than TPO negative patients. Despite the association between positive thyroid TPO antibodies and the subsequent development of hypothyroidism, annual measurement of serum TSH constitutes the good screening test to detect thyroid dysfunction in asymptomatic patients.

The mean serum cholesterol level was significantly increased in cases when compared with control this rise is statistically significant ($p<0.001$).

Table 4: Mean serum cholesterol level:-

	Control (n=50)	Cases (n= 50)	P value
Serum cholesterol(mg/dl)	143.22± 15.45	266.65 ± 36.22	<0.001

Increased serum cholesterol and triglyceride in diabetic patients may be due to abnormal metabolism in body. The composition and the transport of lipoproteins are disturbed in thyroid disorder which leads to hypercholesterolaemia, hypertriglyceridemia and marked increase in low-density lipoproteins (LDL) and apo-lipoprotein B. It may be due to decreased fractional clearance of LDL by a reduced number of LDL receptors in the liver. The HDL levels is also deranged in hypothyroidism due to decreased activity of cholesterol-ester transfer protein (CETP) and hepatic lipase (HL), which activity depends on thyroid hormones's level. Hypothyroidism increases the oxidation of plasma cholesterol. Cardiac oxygen consumption is reduced in hypothyroidism which is associated with increased peripheral resistance and reduced contractility.(18)(19)

V. Conclusion

Thus this study shows the prevalence of abnormal thyroid hormone level among diabetic subjects. The relationship between thyroid disorders and diabetes mellitus is characterized by a complex interdependent interaction. Failure to recognize the presence of abnormal thyroid hormone level in diabetes may be a primary cause of poor management often encountered in some treated diabetics. Therefore, routine assessment of thyroid hormone level in addition to other biochemical parameters in the early stage of diabetes will help in the management of diabetes particularly in those patients whose conditions are difficult to manage

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