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ORIGINAL RESEARCH

A Hospital Based Prospective Study to Evaluate the Lipid Profile in Patients Having Subclinical Hypothyroidism and Type-II Diabetes Mellitus

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ABSTRACT

Background: Both Hypothyroidism and Diabetes alter lipid levels and are the leading causes of dyslipidemia in the current era. However, the pattern of altered lipid profile varies in the two diseases. Hence, the glycemic control in diabetics with Hypothyroidism (overt and subclinical) may not be good despite strict dietary and lifestyle modifications, and there are conflicting reports regarding this observation. The aim of this study to evaluated the lipid profile in patients having subclinical hypothyroidism and type-ii diabetes mellitus.

Materials& Methods: A hospital based prospective study done on 100 Patients aged above 40 years with a past history of type-2 Diabetes mellitus attending medicine OPD in government district hospital, Sirohi, Rajasthan, India during one year period. Lipid profile included Total cholesterol, LDL cholesterol, HDL cholesterol and plasma triglycerides. Fasting thyroid profile including plasma free T3, free T4, and plasma TSH were obtained using standard assays. The data collected were entered in the proforma and subjected to statistical analysis.

Results: Subclinical Hypothyroidism was present in 12% of cases.4% had overt hypothyroidism. Females were significantly higher in proportion than males among those who had subclinical hypothyroidism. The presence of subclinical hypothyroidism was not significantly related to higher levels of HbA1C. There was no significant effect on Total and LDL cholesterol, and HDL cholesterol, in patients with subclinical hypothyroidism.

Conclusion: We concluded that there is a significant increase in the incidence of subclinical hypothyroidism in patients with type 2 diabetes mellitus and this increase is associated with a significant rise in the triglyceride levels.

Keywords: Subclinical hypothyroid, Lipid Profile, Type 2DM, Thyroid profile

INTRODUCTION

Diabetes mellitus is a disorder of glucose metabolism wherein the digested carbohydrates are not metabolized either due to an absolute or relative lack of the hormone insulin, that is derived from the pancreas, or due to a relative peripheral resistance for glucose uptake in tissues like the liver, adipose tissue, and skeletal muscle. Hypothyroidism refers to an absolute or a relative deficiency in the thyroid hormones. Diabetes mellitus is diagnosed

using either Random, fasting, or post prandial plasma glucose levels, or with Glycated haemoglobin (HbA1c) levels in a patient. Hypothyroidism may or may not present with signs and symptoms pertaining to the disease. Whether clinically apparent or not, Hypothyroidism is basically a biochemical diagnosis, done with the help of thyroid function tests. Two of the most common endocrinological diseases are Diabetes and Hypothyroidism.[1]

Hypothyroidism may be subclinical or overt. Since majority of the thyroid hormone triiodothyronine (T3) is formed from peripheral conversion of the thyroid hormone thyroxin (T4) in the tissues, its level in plasma is minimal, and measurement of serum T3 in plasma proves to be a difficult task. Hence, thyroid gland dysfunction is diagnosed mainly using two parameters – Serum free T4 and serum Thyrotropin (Thyroid Stimulating Hormone; TSH) levels.

Subclinical Hypothyroidism is diagnosed in the presence of an elevated serum TSH with a normal Serum free T4 whereas overt Hypothyroidism is diagnosed when there is an elevated serum TSH with decreased free T4. Subclinical Hypothyroidism may be found in 6-8% women and 3% men. The annual risk of developing subclinical Hypothyroidism is about 4% when there is an associated positive TPO antibody. There is a significantly higher proportion of individuals who suffer from thyroid dysfunction in the diabetic population when compared to the general population, the most frequent pattern being subclinical Hypothyroidism, and these thyroid disorders are more prevalent in women than in men.

Both Hypothyroidism and Diabetes alter lipid levels and are the leading causes of dyslipidemia in the current era. However the pattern of altered lipid profile varies in the two diseases. Whereas Diabetes causes abnormalities primarily in High density lipoprotein (HDL) fraction of serum cholesterol, Hypothyroidism primarily affects the Low density lipoprotein (LDL) cholesterol. Both disorders can cause an elevation in the serum triglyceride level. It is important to realize these altered lipid profiles in the above two diseases as they pose a significant risk for atherosclerotic progression and adverse cardiac and vascular outcomes in an individual.[2]

However, the lipid profile pattern in patients suffering from both Diabetes and Subclinical Hypothyroidism has not been studied extensively and remains controversial.

There are many factors that increase the glucose levels in hypothyroid individuals as well. These include an increased peripheral resistance to insulin due to an increase in adipose tissue mass, a decreased expression of glucose receptors in the peripheral tissues, and many more, including altered gene expression for insulin hormone.[3] Hence, the glycemic control in diabetics with Hypothyroidism (overt and subclinical) may not be good despite strict dietary and lifestyle modifications, and there are conflicting reports regarding this observation. The aim of this study to evaluated the lipid profile in patients having subclinical hypothyroidism and type-ii diabetes mellitus.

MATERIAL & METHODS

A hospital based prospective study done on 100 Patients aged above 40 years with a past history of type-2 Diabetes mellitusattending medicine OPD in government district hospital, Sirohi, Rajasthan, India during one year period.

EXCLUSION CRITERIA

- Patients with history of a known thyroid disease.
- Patients with biochemical or clinical features of hyperthyroidism.
- Patients with a critical illness like malignancy, heart failure.
- Patients with abnormal liver or renal function.

METHODS

Relevant history of the patient is taken as per the questionnaire and the patient is also subjected to clinical examination and diagnostic investigations. Informed as well as written consent was attained from either the eligible patients or their legal representatives. Cases were screened according to inclusion and exclusion criteria. All the cases and controls were subjected to clinical and laboratory investigations as per the proforma. The age, diabetic status, medication history, past and family history, were obtained by self report.

Blood pressure measurements were made in the right upper limb in supine posture using a standardized digitals sphygmomanometer. Patients were subjected to a complete General physical and systemic examination and special emphasis made to screen for the microvascular and macrovascular complications of Diabetes. A complete blood count, a liver function test, a renal function test, serum electrolyte panel, fasting lipid and glucose levels were all obtained using standard assays. The HbA1C levels were also obtained from the patients. Lipid profile included Total cholesterol, LDL cholesterol, HDL cholesterol and plasma triglycerides. Fasting thyroid profile including plasma free T3, free T4, and plasma TSH were obtained using standard assays. The data collected were entered in the proforma and subjected to statistical analysis.

STATISTICAL ANALYSIS

Analysis was done using SPSS Version 22.0. Significance was assumed with p value of 0.05. Association between two categorical variables was tested using Chi square test.

RESULTS

The individuals included in the study were separated based on groups into ages 40 – 45 years, 46 – 55 years, 56 – 65 years and more than 65 years. It was observed that majority of the members included in the study fell into the age groups 46 to 55 years (42 out of 100), followed by 56 to 65 years (24 out of 100). However, even though the overall individuals included in the study was higher in the 46 to 55 years age group, the incidence of SCHT was higher in the 56 to 65 years group, with 6 individuals in this group having SCHT (25%). However, the stratification of the observed individuals based on age did not prove to be of any statistical significance ($p>0.05$).

The participants of the study were divided based on the gender and it was observed that 46 individuals out of 100 were males, and 54 were females. Among the male population, 40 individuals (87%) had normal thyroid function, 4 had SCHT (8.7%) and 2 had overt HT (4.34%). Among the females, 44 individuals (81.5%) had normal thyroid function, 8 had SCHT (14.8%) and 2 had overt HT (3.7%). Theincidence of SCHT in patients with type 2 DM is clearly more prominent infemales, and this observation has been statistically significant in the study ($p>0.05$) (table 1).

Table 1: Demographic profile of patients

Demographic profile	Normal (N=84)	Subclinical hypothyroidism (N=12)	Overt hypothyroidism (N=4)	Total (N=100)
Age group (yrs)				
40-45 yrs	14	1	0	15
46-55 yrs	37	3	2	42
56-65 yrs	17	6	1	24
>65 yrs	16	2	1	19
Gender				
Male	40	4	2	46
Female	44	8	2	54

The mean HbA1C value in diabetic individuals without thyroid abnormalities was 7.84 %. The mean HbA1C value in individuals with type 2 DM and Subclinical Hypothyroidism was 8.62 %. The mean duration of Diabetes among diabetic individuals with normal thyroid status was 7.25years, the mean duration among those with SCHT was 5.68 years. So there is no relation between the prevalence of SCHT and the duration of Diabetes.

In patients with Type 2 DM and normal thyroid, 30.9% (26 out of 84) had an abnormal Total cholesterol, whereas in patients with Subclinical Hypothyroidism 50% (6 out of 12) had an abnormal total cholesterol.

53.57% of individuals with normal thyroid function (45 out of 84) had an elevated LDL cholesterol, versus 66.7 percent in patients with SCHT (8 out of 12). The p value was 0.078 and there was no statistical significance between thyroid status and LDL cholesterol.

The prevalence of patients with a low HDL cholesterol was 39.3 percent in normal thyroid status group (33 out of 84) and 50 percent in SCHT group (6 out of 12). This showed a rising trend in the prevalence of abnormal HDL cholesterol levels from normal to subclinical hypothyroid to overt hypothyroid cases.

Among those with SCHT, all patients had triglyceride levels above 100 mg/dl, with 2 patients having levels between 100 and 150 mg/dl (16.67%) and the majority, 10 members (83.34%) having elevated levels of triglycerides >150 mg/dl. The observation that elevated levels of triglycerides are seen in the group with Subclinical Hypothyroidism was statistically relevant ($p>0.05$) (table 3).

Table 2: Mean HbA1C and duration of diabetes in type 2 DM with and without hypothyroidism

Parameters	Without hypothyroidism	Subclinical hypothyroidism	P-value
HbA1c	7.84±1.55	8.62±1.632	>0.05
Mean duration of diabetes (yrs)	7.25±5.36	5.68±2.98	>0.05

Table 3: Lipid profile in type 2 DM with and without hypothyroidism

Lipid profile	Normal (N=84)	Subclinical hypothyroidism (N=12)	Overt hypothyroidism (N=4)	P-value
Total Cholesterole (mg/dl)				
<200 mg/dl	58	6	2	>0.05
>200 mg/dl	26	6	2	
LDL cholesterol (mg/dl)				
<100 mg/dl	39	4	2	>0.05
>100 mg/dl	45	8	2	
HDL cholesterol (mg/dl)				
>40 mg/dl	51	6	2	>0.05
<40 mg/dl	33	6	2	
Serum Triglyceride (mg/dl)				
<100 mg/dl	39	0	1	>0.05
100-149 mg/dl	33	2	0	
>150 mg/dl	12	10	3	

DISCUSSION

Our study showed an incidence of Subclinical Hypothyroidism was 12% which was similar to other studies. The study correlated best with a trial performed in Greece in 2010, where a prevalence of SCHT was 12.4%, as compared to 12 % in our study[4].This study had a higher rate of Subclinical Hypothyroidism comparedto few other studies. In the study in Segovia,

Spain, it was 10.7%[5], and in theFremantle Diabetes Trial, it was 8.8%. The study however did not includetesting the patients for Anti thyroid antibodies (Antibodies to thyroidperoxidase enzyme) that was done in all the studies mentioned above.

The age stratification was not significant statistically in the Greece trialas well (p value 0.17)[4]. The average age of diabetic individuals with anabnormal thyroid function was 65.54 years, compared to 67.12 years indiabetic individuals with a normal thyroid function. There was also nosignificant difference in age in the Fremantle Diabetes Study as well. One study that showed a statistically significant increase in the incidence of SCHTin Type 2 DM was by Kim et al, where the mean age of patients with anormal thyroid status was 57.9 years and those with SCHT was 61.8 years[6].In Karnataka, India, a study in a medical college on hundred andfifteen individuals was performed and the mean age was similar to ours –54.83 years[7]. Another study in South India had a mean age of 58.77 years.

These two studies had similar age group stratification which possiblyindicates that the incidence of SCHT in Type 2 DM in India may occur at aslightly younger age. However more trials are necessary to substantiate thisobservation.

Most of the trials conducted for similar aims have noticed an almostsimilar pattern of distribution of patients. The Fremantle Diabetes Study wasdone exclusively in females and had a lower prevalence of SCHT of about8.7% compared to 14.8% in our study[8]. Chen HS et al revealed in astudy in Taiwan that SCHT was 5.3% in males and 8.4% in females with type2 DM[9]. In the Greek study, the prevalence was much higher at 18.5% infemales, and 5.5 percent in males, the male prevalence being almostcomparable to other studies[4].

Most of the studies comparing Subclinical Hypothyroidism and type 2Diabetes could not come up with a statistically significant correlation between level of thyroid dysfunction and glycemic profile. In contrast, theGreek study on type 2 DM patients showed a reduced HbA1C level inpatients with coexisting Hypothyroidism (7.38% compared to 7.81%)although this was statistically insignificant[4]. The same observation was madeby Kim et al in Taiwan, with a mean HbA1C of 8.8 and 8.4% in euthyroidand hypothyroid diabetic individuals respectively[6]. The variations in theabove observations and the absence of any significant findings is probablydue to the multiple mechanisms by which Hypothyroidism can decrease aswell as increase the blood glucose values.

In the study in Greece, the mean duration was 14.28 and 14.64 yearsamong individuals with and without thyroid dysfunction respectively[4]. Therewas no significance in the duration of Diabetes regarding the prevalence ofthyroid dysfunction. In India, in a study in Karnataka, the mean duration ofDiabetes in the SCHT group was 6.15 years[10]. Two studies in the South EastAsian Region had a mean duration of Diabetes of 8.9 years and 8.3 years[7].

The above difference may be due to the differences in the mean age of SCHpatients in the studies as well – 55.54 in the present study versus 61.7 years inthe study by Kim et al[6]. The percentage of individualswith a higher cholesterol level was more in the SCHT group, the correlationwas statistically not significant.In the study in Greece, it was observed that diabetic patients withthyroid dysfunction had a better lipid profile[4]. Mean total cholesterol valueswere 199.8 and 207.24 in the groups with and without thyroid dysfunctionrespectively. Satvic et al[10] found a higher mean total cholesterol value inpatients with SCHT and Diabetes type 2 but could not elicit any significantcorrelation between the two. The same findings were observed in a trial byKim et al[6].

However, in a study conducted in Western Australia, patients withSCHT had significantly higher total cholesterol levels than euthyroid individuals (mean 243.62 versus 224.28, p value <0.001). In a trial by Grayet al[11], it was observed that diabetic individuals with an increased TSH withoutclinical signs of thyroid failure had a significantly higher mean serum totalcholesterol concentration (262.95 mg/dl in elevated TSH group versus 232.02mg/dl in normal TSH group; p value 0.025) after matching for age and sex.

Papazafiropoulou et al[4] found an improved LDL cholesterol profile indiabetic individuals with abnormal thyroid function which was statisticallysignificant as well (114.94 in dysthyroid individuals versus 128.05 ineuthyroid p value 0.001). Satvic et al[10] and Kim et al[6] found a similar LDLprofile as compared to the present study but could not arrive at a significantcorrelation. In the Fremantle Diabetes study, a significantly higher serumLDL level was observed in the SCHT group than in euthyroid individuals(mean 166.28 versus 135.35, p value <0.001)69. Levothyroxine therapyreduced serum LDL cholesterol levels in a group of SCHT patients observedby Ineck et al[12]. Effects of therapy, however, was not studied in the presentstudy.

Satvic et al[10] compared the mean values of serum HDL cholesterol ineuthyroid and SCHT patients with Diabetes mellitus and found a loweraverage value in SCHT (38.14 versus 40.06) but was insignificant. Similarobservations were made by Kim et al[6]. The Fremantle Diabetes study ondiabetic women showed a lower mean HDL cholesterol in the patients withhigher serum thyrotropin levels (43.7 versus 45.24) but was found to bestatistically insignificant[8]. In Greece, however, the mean HDL cholesterolwas above normal limits in both dysthyroid and euthyroid groups, but the diabetics with abnormal thyroid function had a higher HDL cholesterol (51.7versus 47.35) which was statistically significant[4].

In the trial conducted by Satvic et al, the mean triglyceride level was178 mg/dl in the SCHT group and 151 in the Euthyroid group, but thedifference in the levels was statistically insignificant (p value 0.185)[10]. Kimet al found a lower mean triglyceride value (195 mg/dl in normal thyroidindividuals versus 182 mg/dl in SCHT individuals) in SCHT patientscompared to diabetics with normal thyroid function[6]. The FremantleDiabetes Study[8] and trials conducted by Papazafiropoulou et al[4] also could notelicit a significant correlation between presence of SCHT andhypertriglyceridemia.

CONCLUSION

We concluded that there is a significant increase in the incidence of subclinical hypothyroidism in patients with type 2 diabetes mellitus and this increase is associated with a significant rise in the triglyceride levels. There is no correlation between HbA1C, total cholesterol, and LDL and HDL cholesterol with presence of subclinical hypothyroidism.

REFERENCES

1. Biondi B, Cooper DS. The clinical significance of subclinical thyroid dysfunction. Endocr Rev. 2008;29(1):76.
2. Umpierez GE, Stentz F, Latif KA, Bush A, Murphy MB, Kitabchi AE, Lambeth HC. Thyroid dysfunction in patients with type 1 diabetes. Diabetes Care. 2003;24(4):1181-85.
3. Diez JJ, Sanchez P, Iglesias P. Prevalence of thyroid dysfunction in patients with type 2 diabetes. ExpClinEndocrinol Diabetes. 2011; 119(4):201-7.
4. Papazafiropoulou A, Sotiropoulos A, Kokolaki A, Kardara M, Stamataki P, Pappas S. Prevalence of Thyroid Dysfunction Among Greek Thype 2 Diabetic Patients Attending an Outpatient Clinic. J Clin Med Res. 2010;2(2):75-78.
5. Umpierez GE, Stentz F, Latif KA, Bush A, Murphy MB, Kitabchi AE, Lambeth HC. Thyroid dysfunction in patients with type 1 diabetes. Diabetes Care. 2003;24(4):1181-85.
6. Kim BY, Kim CH, Jung CH, Mok JO, Suh KI, Kang SK. Association between subclinical Hypothyroidism and severe diabetic retinopathy in Korean patients with Type 2 diabetes. Endocr J. 2011 Sep 17.
7. Swamy RM, Naveen K, Srinivasa K, Manjunath GN, Prasad BDS, Venkatesh G. Evaluation of Hypothyroidism as a complication in Type 2 Diabetes Mellitus. Biomedical Research 2012;23(2):170-172.

8. Chubb SA, Dawis WA, Inman Z. Prevalence and progression of subclinical hypothyroidism in women with type 2 diabetes: The Fremantle Diabetes Study. ClinEndocrinol (Oxf) 2005;62:480-6.
9. Chen HS, Wu TE, Jap TS. Subclinical Hypothyroidism is a risk factor for nephropathy and cardiovascular diseases in type 2 Diabetic patients. Diabet Med 2007;24:1336-44.
10. Satvic C.M, Vishwanath K, Balaraj K.P, Srinivasa P, Poornachandra M.V. Prevalence of subclinical thyroid disorders in type 2 Diabetes Mellitus. International Journal of Medicine and Public Health 2013;3(4):330-334.
11. Gray RS, Smith AF, Clarke BF. Hypercholesterolemia in Diabetics with Clinically Unrecognised Primary Thyroid Failure. HormMetab Res 1981; 13(9): 508-510.
12. Ineck BA, Ng TM. Effects of subclinical hypothyroidis and its treatment on serum lipids. Ann Pharmacother. 2003;37(5):725-30.