

Dyslipidemia in Patients of Hypothyroidism

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Abstract:

Background: Thyroid disorders are more prevalent in women, and can cause many problems including weight gain and hormonal imbalance. Hypothyroidism is related with various biochemical changes. Increased levels of TC (Total Cholesterol) and LDL (Low Density Lipoproteins) are seen when thyroid function decreases. So, we designed the study to evaluate patients of Thyroid dysfunction and its effects on the lipid profile.

Material & Methods: A Case Control Study was conducted on Patients with thyroid disorder attending both OPD and IPD in Department of Medicine in MGMCH, Jaipur, Rajasthan during December 2015 to December 2016. A total of 80 Subjects, 40 subjects with thyroid disorder and 40 euthyroid controls were included in the study. Presence of thyroid dysfunction is defined as per American Thyroid Association Guidelines.

Results: Our results showed that the mean age of patients was 38 years, with a female preponderance over males in our study. The mean BMI in the cases was 24.04 ± 2.821 kg/m² when compared to 23.18 ± 2.333 kg/m² in controls; but it was not statistically significant ($P=0.1432$) (table 1). The mean value of TSH, Total T3 & Total T4 was statistically significant ($P<0.0001$ ***, $P=0.0289$ * & $P=0.0116$ * respectively). The significant rise of serum cholesterol, LDL, VLDL & TG but without increased HDL levels were observed in hypothyroid patients.

Conclusion: We concluded that the thyroid abnormalities were more common in the elderly female patients. Total Cholesterol, LDL, VLDL and Triglycerides were observed to rise with declining thyroid function and rising TSH levels. Cases of subclinical hypothyroidism could also be identified on the basis of high TSH levels in the face of normal T3, T4 values.

Key Words: Hypothyroidism, TC, TG, LDL, VLDL, HDL

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I. Introduction

Thyroid dysfunction is one of the leading endocrine disorders. It represents around 30% to 40% of the patients seen in endocrine practice. The American Association of Clinical Endocrinologists (AACE) estimated that in the United States approximately 13 million people, or 4.78% of the population, have undiagnosed thyroid dysfunction.¹ Thyroid disorders are more prevalent in women as compared to men and can cause many problems including weight gain and hormonal imbalance. In the developed countries, the prevalence of thyroid disorders is about 4% to 5%.²

The current data on the prevalence of thyroid disorders such as thyroid nodules, hyperthyroidism, goiter, thyroiditis, and thyroid cancer, is almost 32% in the Indian population. The most prevalent form of thyroid disorder across the country is sub-clinical hypothyroidism, which is a milder form of hypothyroidism. What is more alarming is, that it is a silent form of the disease.² Hypothyroidism is related with various biochemical changes. Increased levels of TC and LDL are seen when thyroid function decreases.³ Thus hypothyroidism comprises a significant cause of secondary dyslipidemia.⁴

Nikkilia & Kekki⁵ have postulated that decreased activity of lipoprotein lipase (LPL), results in decreased clearance of triglyceride-rich lipoproteins in hypothyroidism patients who have hypertriglyceridemia. The incidence of hyperthyroidism has been found to be very low in patients with dyslipidemia. Tsimihodimos et al found that hyperthyroidism was present in only 1.2% of patients attending their lipid clinic.²

Various studies have been done in the past on lipid profile in hypothyroid patients. But controversies still remain. So, we have designed the present study to evaluate patients of Thyroid dysfunction and its effects on lipid profile.

II. Material & Methods

A Case Control Study was conducted on Patients with thyroid disorder attending both OPD and IPD in Department of Medicine in Mahatma Gandhi Medical College, Jaipur, Rajasthan between December 2015 and December 2016. A total of 80 Subjects, 40 subjects with thyroid disorder and 40 euthyroid controls were selected in study.

Inclusion criteria:

- All patients with thyroid dysfunction

Exclusion criteria:

- Patients with chronic liver disease.
- Patients already treated for thyroid disorders.
- Coagulation disorders.
- Severe systemic disease.
- Pregnancy.
- Renal failure
- Malignancy
- Underlying known cardiac disorder

Procedure

Fasting blood samples were taken in a plain gel vacutainer tube under aseptic conditions. The samples were centrifuged within 1 hour at 3000 rpm for 5 min. These were processed to obtain serum for the estimation of serum lipid profile and thyroid hormone level. Estimation of fasting lipid profile (TG, cholesterol, and HDL) was carried out on a fully automated Cobas Integra 400 plus clinical chemistry analyzer. LDL value was derived by Friedwald's formula: $\{LDL = Total\ Cholesterol - [HDL + (Triglyceride/5)]\}$. And thyroid function test was estimated with electrochemiluminescence method on Elecsys 2010. T3, T4, and FT4 levels were estimated by competitive principle and TSH by sandwich principle.

Thyroid dysfunction was identified as per American Thyroid Associations Guidelines.

Dyslipidemia was labeled as per NCEP ATP II and IDF Guidelines:

- Total cholesterol >200mg/dl
- Triglyceride >150mg/dl
- HDL <40 mg/dl
- LDL >100 mg/dl

Data Analysis:-

Statistical analysis of the data was done by SPSS (version 2016) where the values ≤ 0.05 was considered as significant.

III. Results

In our study the mean age of patients was 38 years which did not differ significantly from the mean age of 42.58 years in the control group ($P=0.1417$) (Graph 1). There was preponderance of females over males in our study (4.7:1 in the study group & 3.4:1 in the control group).

The mean BMI in the studied cases was 24.04 ± 2.821 kg/m² as compared to 23.18 ± 2.333 kg/m² in controls, but the difference was not statistically significant ($P=0.1432$) (Table 1). The difference in the mean value of TSH, Total T3 & Total T4 between cases and controls was statistically significant ($P < 0.0001^{***}$, $P=0.0289^*$ & $P=0.0116^*$) respectively (Table 2).

We observed that lipid fractions were significantly elevated in the study group as compared to controls. Serum Cholesterol (184.0 ± 39.72 mg/dl v/s 132.5 ± 18.63 mg/dl; $P < 0.0001^{***}$), Serum LDL (120.7 ± 27.36 mg/dl v/s 101.6 ± 12.66 mg/dl; $P=0.0001^{***}$), Serum VLDL (25.68 ± 7.043 mg/dl v/s 20.35 ± 3.009 mg/dl; $P < 0.0001^{***}$) and Serum TG (143.8 ± 40.62 mg/dl v/s 116.3 ± 14.81 mg/dl; $P=0.0001^{***}$). However, there was no significant difference between cases and controls when mean values of HDL were statistically analysed (Table 3).

IV. Discussion

Hypothyroidism is a clinical syndrome resulting from a deficiency of thyroid hormones. These hormones regulate a wide array of metabolic activities. It is a common metabolic disorder in the general population, more common in females, the incidence increasing with advancing age.

This study showed female preponderance which was similar to the observations of Bhandopadhyay et al.,⁶ who found that females constituted 78% of the study population. Thyroid disease is much more prevalent in female than male; females were 5–8 fold more likely to develop hypothyroidism. Other studies done by Singh K et al.⁷ and Saini V et al.⁸ showed that females constituted 88% & 80.22% of the study population respectively. Higher incidence of thyroid disorder in the middle aged and younger age groups may be attributed to higher levels of stress and possibly environmental pollutants. The mean age of cases was 38 years which was similar to the observations by Bhandopadhyay et al.⁶ where it was 38.56 years and 31.55 ± 2.1 years in another study

done by Saini V et al⁸. In controls mean age was 42.58 years (p=0.1417), which is similar to results in the present study.

The mean BMI in cases in our study was 24.04±2.821 kg/m² when compared to 23.18±2.333 kg/m² in control, but the difference was not statistically significant (P=0.1432). This finding was in sharp contrast to a study done by Kong WM et al¹⁰ where mean BMI was 25.5kg/ m².

In our study TSH levels >5 µ IU/ml were found in 95% cases which contrasted sharply with the 5% controls with levels above this range (P<0.0001***) and normal FT3 and FT4 levels as defined by inclusion criteria which is similar to a study done by Singh K et al⁷ and Saini V et al,⁸ where the cut off limit for TSH was > 5.0 µ IU/ml and 6.1 µ IU/ml respectively. The observation suggested that the effect of hypothyroidism in the lipid metabolism is more noticeable in patients with higher serum TSH levels.

In the present study, significantly higher levels of serum cholesterol (184.0±39.72 mg/dl v/s 132.5±18.63 mg/dl; P<0.0001***), serum LDL (120.7±27.36 mg/dl v/s 101.6±12.66 mg/dl; P=0.0001***), serum VLDL (25.68±7.043 mg/dl v/s 20.35±3.009 mg/dl; P<0.0001***) and serum TG (143.8±40.62 mg/dl v/s 116.3±14.81 mg/dl; P=0.0001***). However, there was no statistically significant difference between cases and controls when mean values of HDL were compared. This may be due to the fact that subclinical hypothyroidism may cause a gradual decline of thyroid hormone levels in the serum and tissues^{11,12}. Additionally, raised TSH levels encourage *HMGCR* expression by encouraging the cyclic adenosine monophosphate/protein kinase A/cyclic adenosine monophosphate-responsive component binding protein (cAMP/ PKA/CREB) cassette¹³.

Our results are in conflict with the results of Kuldip Singh & Saranpal Singh (2011)⁷ who found a significant increase in triglycerides and very low density lipoprotein cholesterol levels, while a nominal increase in TC, LDL and HDL levels.

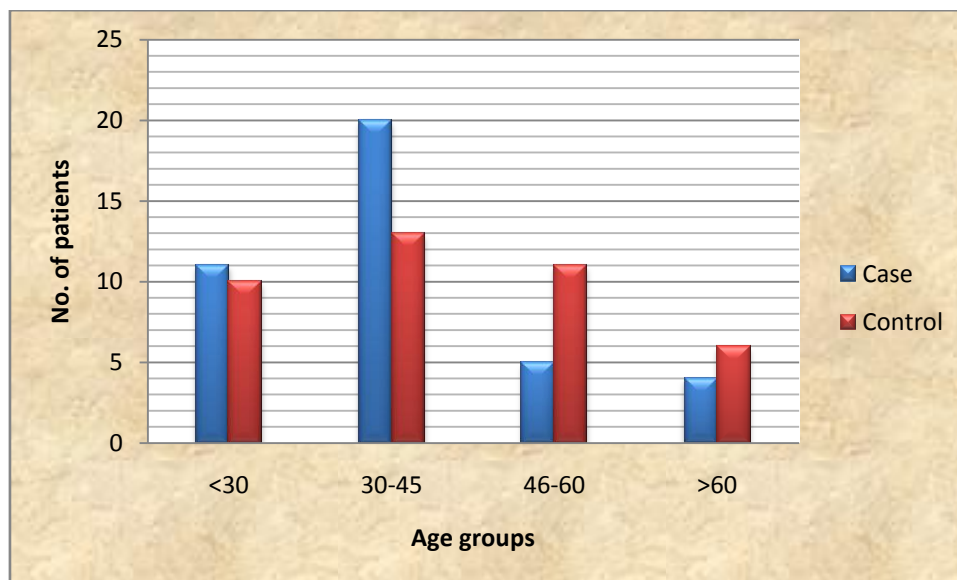
Bijay K.M et al (2007)¹⁴ observed that lipid levels were significantly increased in cases with raised TSH. Similar findings were observed by Sangeeta N et al (2016)¹⁵.

V. Conclusion

On the basis of the present study, as also found by the earlier referenced works of Indian and Western researchers, we have come to the conclusion that females form the bulk of patients with clinical as well as subclinical hypothyroidism. This is more evident in the elderly cases. It is also evident that abnormally high levels of Total Cholesterol, LDL, VLDL and Triglycerides are associated with declining thyroid function and raised TSH levels. It is also evident that subclinical hypothyroidism can be identified on the basis of the biochemical abnormality of raised TSH levels in the presence of normal T3 and T4 levels.

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Graph 1: Age wise distribution of case and control group

Table 1: Mean BMI (Kg/m²) of case and control group

BMI (Kg/m ²)	Cases	Control	T	P- value
Mean	24.04	23.18	1.479	0.1432
SD	2.821	2.333		
Median	24.551	23.32		
Minimum	18.66	18.12		
Maximum	28.42	27.84		

Table 2: Mean Thyroid Level of case and control group

Parameters	Cases	Control	T	df	P- value
TSH (μIU/ml)	9.523±3.954	2.57±0.8589	10.86	78	<0.0001***
TotalT3 (ng/dl)	124.7±36.22	139.6±22.09	2.226	78	0.0289*
TotalT4 (μg/dl)	7.206±4.236	9.049±1.547	2.584	78	0.0116*

Table 3: Mean Lipid Parameters (mg/dl) of case and control group

Parameters	Cases	Control	T	P- value
Serum Cholesterol	184.0±39.72	132.5±18.63	7.431	<0.0001
LDL	120.7±27.36	101.6±12.66	4.002	0.0001
HDL	38.53±6.421	36.10±4.162	2.004	0.0485
VLDL	25.68±7.043	20.35±3.009	4.397	<0.0001
TG	143.8±40.62	116.3±14.81	4.019	0.0001

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