EFFECTS OF THYROID DYSFUNCTION ON LIPID PROFILE

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Abstract

Background: Thyroid function regulates a wide array of metabolic parameters. Thyroid function significantly affects lipoprotein metabolism as well as some cardiovascular disease (CVD) risk factors, thus influencing overall CVD risk.

Methods: A cross sectional study has been conducted to assess the association of subclinical hypothyroidism and overt hypothyroidism with lipid abnormalities.

Results: Serum HDL cholesterol in group A was 37.97 ± 7.97 mg/dl, that in group B was 37.62 ± 6.67 mg/dl, while in group C it was 36.27 ± 5.79 mg/dl. Serum LDL cholesterol in group A was 150.9 ± 29.70 mg/dl, that in group B was 115.2 ± 22.02 mg/dl, while in group C it was 93.07 ± 19.88 mg/dl. Serum total cholesterol in group A was 223 ± 32.69 mg/dl, that in group B was 179.67 ± 27.50 mg/dl, while in group C it was 152.4 ± 21.47 mg/dl. Serum VLDL cholesterol in group A was 34.12 ± 11.06 mg/dl, that in group B was 26.85 ± 4.01 mg/dl, while in group C it was 23.05 ± 3.09 mg/dl. Serum VLDL cholesterol in group A was 167.42 ± 47.83 mg/dl, that in group B was 134.37 ± 20.22 mg/dl, while in group C it was 115.17 ± 15.66 mg/dl.

Conclusion: Thyroid dysfunction can have an important effect on lipid profile. Biochemical screening for thyroid dysfunction is critical in all dyslipidemic patients, as well as in all patients with unexpected improvement or worsening of their lipid profile.

Keywords: LDL, HDL, Cholesterol.

Introduction:

Thyroid disease, namely hypothyroidism and hyperthyroidism, constitutes the most common endocrine abnormality in recent years, diagnosed either in subclinical or clinical form. According to the 6-year duration NHANES III Study, the prevalence of hypothyroidism was 4.6% (0.3% clinical and 4.3% subclinical) and of hyperthyroidism 1.3% (0.5% clinical and 0.7% subclinical), in population aged at least 12 years, showing an age and sex dependence¹

Thyroid disease is associated with various metabolic abnormalities, due to the effects of thyroid hormones on nearly all major metabolic pathways. Thyroid hormones regulate the basal energy expenditure through their effect on protein, carbohydrate, and lipid metabolism. This might be a direct effect or an indirect effect by modification of other regulatory hormones such as insulin or catecholamines².

Dyslipidemia is a common metabolic abnormality in patients with thyroid disease, either in the overt or subclinical forms of the disease, and constitutes the end result of the effect of thyroid hormones in all aspects of lipid metabolism leading to various quantitative and/or qualitative changes of triglycerides, phospholipids, cholesterol, and other lipoproteins^{3,4}.

MATERIAL AND METHODS

The study has been conducted at Department of Medicine, Dr. S.N. Medical College & MDM Hospital, Jodhpur, which included patients who visited out-patient and in-patient departments.

Study Design:

A cross sectional study has been conducted to assess the association of subclinical hypothyroidism and overt hypothyroidism with lipid abnormalities.

Sample size:

40 patients with subclinical hypothyroidism and 40 patients with overt hypothyroidism have been studied and 40 persons of age, sex and BMI matched have been taken as control. The study has been done for a period of 1 year.

Inclusion criteria:

Clinically and biochemically newly diagnosed hypothyroid patients (subclinical and overt) of both sexes, age 20 to 60 years, with no history of thyroxine and hypolipidemic drugs in the last 3 (three) months have been included in the study.

Exclusion Criteria:

Patients with:

1. chronic renal failure
2. diabetes mellitus
3. liver diseases
4. chronic diseases
5. pregnancy
6. women on oral contraceptives
7. age less than 20 and more than 60 years
8. underweight and obese persons

Study Parameters:

1. Clinical Examination: History and physical examination.
2. Biochemical Tests : Fasting blood sugar, BUN, S.creatinine, S.bilirubin, SGOT, SGPT
3. Routine Investigation : Urine complete, ECG, Chest X-ray
4. Specific Investigation: Thyroid function test (T3, T4, TSH), Lipid profile (after 12 hrs overnight fasting) for Cholesterol, Triglycerides, HDL Cholesterol, LDL Cholesterol, HDL: LDL ratio, VLDL.

The patients in the study were classified into following three groups based on their thyroid function tests:

GROUP 1:

Overt hypothyroidism defined as elevated TSH level, with T3 or T4 concentration below normal.

GROUP 2:

Subclinical hypothyroidism defined as elevated TSH level, with a normal T3 & T4 concentration.

GROUP 3:

Normal healthy euthyroids as controls.

Ethical clearance:-

Before the commencement of the study, Ethical Clearance was obtained from the Ethical and Research Committee, Dr. S.N. Medical College and Hospitals, Jodhpur.

Informed consent:- An informed consent have been taken from the patients regarding participation in the study. In the selected patients appropriate history regarding duration of disease and treatment have been elicited. Detailed clinical examination has been performed. Serum lipid profile and thyroid function test has been performed.

Statistical analysis:-

The data obtained has been coded and entered into Microsoft Excel Worksheet. The categorical data has been expressed as rates, ratios and proportions and chi-square test has been used to compare the data. The continuous data have been expressed as mean $\pm$ standard deviation (SD) and the comparison has been done using unpaired 't' test. A probability value ('p' value) of less than or equal to 0.05 has been considered as statistically significant.

OBSERVATIONS AND RESULTS

TABLE 1: Serum HDL cholesterol

HDL (mg/dl)	Group A	Group B	Group C
Mean±Sd	37.97±7.97	37.62±6.67	36.27±5.79
p value	A v/s B = 0.832 A v/s C = 0.278 B v/s C = 0.336		

In the present study, it has been observed that the mean value of Serum HDL cholesterol in group A was 37.97±7.97 mg/dl, that in group B was 37.62±6.67 mg/dl, while in group C it was 36.27±5.79 mg/dl. When compared using student t-test, the values were statistically insignificant between group A and B (p=0.832), between group A and C (p=0.278) and between group B and C (p=0.336).

TABLE 2: Serum LDL cholesterol

LDL (mg/dl)	Group A	Group B	Group C
Mean±Sd	150.9±29.70	115.2±22.02	93.07±19.88
p value	A v/s B = <0.0001 A v/s C = <0.0001 B v/s C = <0.0001		

In the present study, it has been observed that the mean value of Serum LDL cholesterol in group A was 150.9±29.70 mg/dl, that in group B was 115.2±22.02 mg/dl, while in group C it was 93.07±19.88 mg/dl. When compared using student t-test, the values were statistically significant between group A and B (p<0.0001), between group A and C (p<0.0001) and between group B and C (p<0.0001).

TABLE 3: Serum total cholesterol

Serum Cholesterol (mg/dl)	Group A	Group B	Group C
Mean±Sd	223±32.69	179.67±27.50	152.4±21.47
p value	A v/s B = <0.0001 A v/s C = <0.0001 B v/s C = <0.0001		

In the present study, it has been observed that the mean value of Serum total cholesterol in group A was 223±32.69 mg/dl, that in group B was 179.67±27.50 mg/dl, while in group C it was 152.4±21.47 mg/dl. When compared using student t-test, the values were statistically significant between group A and B (p<0.0001), between group A and C (p<0.0001) and between group B and C (p<0.0001).

TABLE 4: Serum VLDL cholesterol

VLDL (mg/dl)	Group A	Group B	Group C
Mean±Sd	34.12±11.06	26.85±4.01	23.05±3.09
p value	A v/s B = 0.0002 A v/s C = <0.0001 B v/s C = <0.0001		

In the present study, it has been observed that the mean value of Serum VLDL cholesterol in group A was 34.12±11.06 mg/dl, that in group B was 26.85±4.01 mg/dl, while in group C it was 23.05±3.09 mg/dl. When compared using student t-test, the values were statistically significant between group A and B (p<0.0002), between group A and C (p<0.0001) and between group B and C (p<0.0001).

TABLE 5: Serum triglycerides

Triglycerides (mg/dl)	Group A	Group B	Group C
Mean±Sd	167.42±47.83	134.37±20.22	115.17±15.66
p value	A v/s B = 0.0001 A v/s C = <0.0001 B v/s C = <0.0001		

In the present study, it has been observed that the mean value of triglycerides in group A was 167.42±47.83 mg/dl, that in group B was 134.37±20.22 mg/dl, while in group C it was 115.17±15.66 mg/dl. When compared using student t-test, the values were statistically significant between group A and B (p=0.0001), between group A

and C ($p<0.0001$) and between group B and C ($p<0.0001$).

DISCUSSION

The present study has been conducted in the Department of Medicine, Dr. S.N. Medical College & MDM Hospital, Jodhpur. A newly diagnosed 40 patients with overt hypothyroidism and 40 patients with subclinical hypothyroidism were studied for lipid abnormalities, and compared with 40 persons of age, sex and BMI matched controls.

In the present study, it has been observed that the mean value of Serum HDL cholesterol in group A was 37.97 ± 7.97 mg/dl, that in group B was 37.62 ± 6.67 mg/dl, while in group C it was 36.27 ± 5.79 mg/dl. These values were statistically insignificant between group A and B ($p=0.832$), between group A and C ($p=0.278$) and between group B and C ($p=0.336$).

In the study conducted by Lee WY, Suh JY, Rhee EJ et al⁵ no significant difference in HDL was found between hypothyroid cases and euthyroid controls.

In another study by Efstathiadou Z, Bitsis S, Milonis HJ, et al⁶ serum HDL level in subclinical hypothyroidism ($n=66$) was 57 ± 16 mg/dl when compared to euthyroid control ($n=75$), it was 55 ± 12 mg/dl which was statistically insignificant.

In the present study, it has been observed that the mean value of Serum LDL cholesterol in group A was 150.9 ± 29.70 mg/dl, that in group B was 115.2 ± 22.02 mg/dl, while in group C it was 93.07 ± 19.88 mg/dl. These values were statistically significant between group A and B ($p<0.0001$), between group A and C ($p<0.0001$) and between group B and C ($p<0.0001$).

The study done by Sunanda V et al² showed a high LDL cholesterol among the cases of hypothyroidism ($n=75$) with a statistically significant difference ($p<0.001$) when compared with euthyroid controls ($n=25$). Another study done by Khan MAH et al⁷ also showed significant high LDL ($p<0.001$) among hypothyroidism cases ($n=80$) where LDL was 151.96 ± 59.60 mg/dl when compared to euthyroid controls ($n=31$) where LDL was 71.43 ± 26.83 mg/dl.

The results of this study were also similar to study done by Dr. Saima Mushtaq et al⁸ where mean LDL-C was 223.54 mg/dl in overt hypothyroidism cases ($n=40$) while it was 131.043 mg/dl in subclinical hypothyroidism cases ($n=40$) when compared to euthyroid controls ($n=40$) where it was 99.07 mg/dl ($p<0.0001$).

In the present study, it has been observed that the mean value of Serum total cholesterol in group A was 223 ± 32.69 mg/dl, that in group B was 179.67 ± 27.50 mg/dl, while in group C it was 152.4 ± 21.47 mg/dl. These values were statistically significant between group A and B ($p<0.0001$), between group A and C ($p<0.0001$) and between group B and C ($p<0.0001$).

Study done by Khan MAH et al⁷ showed significant high total cholesterol ($p<0.001$) among hypothyroidism cases ($n=80$) where it was 241.56 ± 60.05 mg/dl when compared to euthyroid controls ($n=31$) where it was 146.94 ± 23.21 mg/dl.

Observation of this study were also similar with study done by Sunanda V et al², Dr. Saima Mushtaq et al⁸ and Jung CH et al⁹.

In the present study, it has been observed that the mean value of Serum VLDL cholesterol in group A was 34.12 ± 11.06 mg/dl, that in group B was 26.85 ± 4.01 mg/dl, while in group C it was 23.05 ± 3.09 mg/dl. These values were statistically significant between group A and B ($p<0.0002$), between group A and C ($p<0.0001$) and between group B and C ($p<0.0001$).

These results were similar with the study conducted by Pearce EN et al¹⁰ where VLDL was significantly increased in hypothyroid cases when compared to euthyroid controls ($p<0.001$).

In the present study, it has been observed that the mean value of Serum VLDL cholesterol in group A was 167.42 ± 47.83 mg/dl, that in group B was 134.37 ± 20.22 mg/dl, while in group C it was 115.17 ± 15.66 mg/dl. These values were statistically significant between group A and B ($p=0.0001$), between group A and C ($p<0.0001$) and between group B and C ($p<0.0001$).

Study done by Khan MAH et al⁷ where serum triglyceride was significantly high among hypothyroidism patients ($n=80$) where it was 212.28 ± 100.73 mg/dl compared to euthyroid controls ($n=31$) where it was 98.87 ± 39.69 mg/dl with p value <0.001 .

Another study done by Dr. Saima Mushtaq et al⁸ showed mean serum triglycerides value of 200.27 mg/dl in overt hypothyroid patients ($n=40$) and 173.8 mg/dl in subclinical hypothyroidism patients ($n=40$) compared to euthyroid controls ($n=40$) where it was 108.27 mg/dl with p value <0.0001 . Similar results

were found in study done by Sunanda V et al² with $p < 0.001$.

CONCLUSION

Thyroid dysfunction can have an important effect on lipid profile. Biochemical screening for thyroid dysfunction is critical in all dyslipidemic patients, as well as in all patients with unexpected improvement or worsening of their lipid profile.

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