

CORRELATION OF NON-HIGH-DENSITY LIPOPROTEIN CHOLESTEROL WITH LIPOPROTEIN(A) IN DIABETIC PATIENTS

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ABSTRACT

Objective: The objective of this study is to estimate the level of lipoprotein(a) and lipid profile, especially non-high-density lipoprotein cholesterol (non-HDL-C) in diabetic patients, and to correlate the same with healthy controls (non-diabetics).

Methods: A total of 30 non-diabetic subjects and 30 diabetic patients were included in the study. Lipoprotein(a) [Lp(a)] was estimated by immunoturbidimetry and the other parameters by their respective methods in biochemistry auto-analyzer.

Result: From the study, it was found that both Lp(a) and non-HDL-C were increased in diabetics when compared to the non-diabetic controls. It was also evident that there is a positive correlation of Lp(a) levels with non-HDL C.

Conclusion: Lp(a) and non-HDL C are responsible for atherogenic events in uncontrolled diabetic patients, leading to risks such as coronary artery disease.

Keywords: Lipoprotein(a), Non-high-density lipoprotein, Coronary artery disease.

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INTRODUCTION

According to the World Health Organization, "The term diabetes mellitus (DM) describes a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat, and protein metabolism resulting from defects in insulin secretion, insulin action, or both."

Low-density lipoprotein-cholesterol (LDL-C) till now is being considered as the most important analyte in cardiovascular prevention. Treatment modalities are most often based on lowering the LDL-C. However, along with LDL-C, very LDL (VLDL-C) and the so-called remnant lipoproteins are also atherogenic.

Hence, the need for an individual alternative analyte that would reflect all of the atherogenic particles is justified. This is better understood by calculating the non-high-density lipoprotein C (non-HDL-C) concentration.

According to a study conducted in South India by Kumpatla *et al.* [1], non-HDL-C is the most common lipid abnormality among Type 2 DM (T2DM) patients in patients with coronary artery disease with a prevalence of 21.6% among patients who were already on lipid-lowering agents (Statins) and with normal LDL-C levels. With normal LDL-C levels, 47% of the T2DM patients with CV events had elevated non-HDL-C. The study, hence, tells us the importance of conducting more studies on non-HDL-C as a unique risk predictor of diabetic complications.

Lipoprotein(a) [Lp(a)] is a lipoprotein subclass, rich in cholesterol, and was first described by Berg in 1963 [2]. Lp(a) contains a LDL C particle which is attached to apolipoprotein(a) and a glycoprotein [3,4] and acts as an atherogenic factor as well.

The main objective of the study is to estimate the level of Lp(a) and lipid profile, especially non-HDL C in diabetic patients, and to correlate the same with healthy controls (non-diabetics).

MATERIALS AND METHODS

A total of 60 patients attending a private medical college and hospital at Chennai participated in the study were selected.

Study individuals were divided into two groups.

Group A - 30 age- and sex-matched healthy non-diabetic controls with hemoglobin A1c (HbA1c) <5.6%. The samples of both the groups were

Table 1: Methods of estimation

| Parameter | Method |
|-------------------|--------------------------------|
| Lp (a) | Immunoturbidimetry |
| Total cholesterol | Cholesterol oxidase-peroxidase |
| HDL-C | Direct antibody inhibition |

Non-HDL-C was calculated using the formula: Non-HDL-C: Total cholesterol- HDL cholesterol. Non-HDL-C: Non-high density lipoprotein cholesterol, Lp (a): Lipoprotein (a)

Table 2: Lp (a) and non-HDL among Group A

| Parameter | n | Minimum | Maximum | Mean±SD |
|-----------------|----|---------|---------|---------------|
| Lp (a) mg/dl | 30 | 8.1 | 12.6 | 10.29±1.288 |
| Non-HDL-C mg/dl | 30 | 56 | 157 | 111.83±26.621 |

Non-HDL-C: Non-high-density lipoprotein cholesterol, Lp (a): Lipoprotein (a), SD: Standard deviation

Table 3: Lp (a) and non-HDL among Group B

| Parameter | n | Minimum | Maximum | Mean±SD |
|-----------------|----|---------|---------|---------------|
| Lp (a) mg/dl | 30 | 14.9 | 28.6 | 22.12±4.3154 |
| Non-HDL-C mg/dl | 30 | 153 | 263 | 207.73±29.027 |

Non-HDL-C: Non-high-density lipoprotein cholesterol, Lp (a): Lipoprotein (a), SD: Standard deviation

Table 4: Student's t-test

| Dependent variable | Group | Group | Mean difference (AB) | Standard error | Significance | 95% confidence interval | |
|--------------------|-------|-------|----------------------|----------------|--------------|-------------------------|-------------|
| | | | | | | Lower bound | Upper bound |
| Lp (a) | A | B | -11.83* | 0.822 | <0.0001 | -13.476 | -10.184 |
| Non-HDL-C | A | B | -95.90* | 7.191 | <0.0001 | -110.294 | -81.506 |

*The mean difference is significant at the 0.05 level. Non-HDL-C: Non-high-density lipoprotein cholesterol, Lp (a): Lipoprotein (a)

collected and estimated for certain parameters by their respective methods (Table 1).

Group B - 30 diabetic patients with HbA1c 8-9% and of age group 40-50 years.

After the approval by the Institutional Research and Ethical Committee, written informed consent was obtained from all the participants enrolled. Demographic data, age, gender, duration of diabetes, general history, and medications were recorded. Fasting blood samples were collected. The concentrations of Lp(a), total cholesterol, and HDL-C were measured (Tables 2,3).

Patients with estrogen depletion and hypothyroidism were excluded from the study.

RESULTS

The study population comprised of a total of 60 individuals, and of these, Group A was 30 healthy controls and Group-B was 30 diabetics.

The biochemical study parameters were analyzed with the help of Statistical Product and Service Solutions 22 software.

To find the difference in group means and statistical significance, Student's t-test was used.

The results obtained clearly show an increased concentration of the parameters Lp(a) and non-HDL-C in Group B (diabetic patients) when compared to the healthy controls, with a significance of $p < 0.05$ (Table 4).

DISCUSSION

The study was done on diabetic patients. Between the study group and the control group, both Lp(a) and non-HDL-C levels differed significantly.

The atherogenic property of Lp(a) is illustrated by its capacity to bind with fibronectin in a study conducted by Salonen *et al.* [5]. Lp(a) inhibits binding of plasminogen to the cell surface by accumulating in the vessel wall. This, in turn, reduces the plasmin generation, thereby increasing the clot formation and promoting proliferation of smooth muscle cells. There are other studies conducted worldwide showing the significantly high Lp(a) among renal patients and also the early possibilities of coronary heart diseases development because of the proatherogenic effect of the increased Lp(a) [4-9] supporting our study.

Furthermore, there are various studies conducted worldwide which shows non-HDL-C as the potent marker in risk factor evaluation of atherosclerosis [10-13] and eventually coronary artery disease [14-17].

According to a study conducted in Malaysia, lipid abnormalities are frequently found in diabetes patients and are associated with increased risk of CHD [18].

The study conducted by Nayak and Bhaktha. shows important difference among biochemical parameters and other risk factors in the Asian phenotypic races with countries such as India and Trinidad. The data also showed that Indian diabetic population is at higher risk of developing complications when compared to Trinidadians [19].

These studies clearly depict the importance of Lp(a) and non-HDL-C as independent parameters and the study conducted by us reveals that the duo can act as combined parameters in routine diabetic profile biochemical investigations would help in predicting the diabetic complications in a better way among the Indian population.

CONCLUSION

The results of this study and previous studies provide ample evidence that Lp(a) and Non-HDL-C levels are increased in diabetics compared to the normal Lp(a) and non-HDL-C levels in non-diabetic controls. The present study observed that there is a positive correlation of Lp(a) concentration and Non -HDL-C concentration with the patients with DM, proving their role in diabetic complications such as coronary artery disease and chronic renal failure.

AUTHOR'S CONTRIBUTION

I declare that I, the author has made substantial contributions to conception and design, acquisition, analysis, and interpretation of data. The author has also participated in drafting and revising the article and given his approval for submission and intellectual content.

ETHICAL STANDARDS

All procedures performed in the study involving human participants were in accordance with the ethical standards of the institution (Ref. No. 002/SBMCH/IHEC/2013-056). Informed consent was obtained from all individual participants included in the study.

CONFLICTS OF INTEREST

The author declared that they had no conflicts of interest.

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