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Biochemistry

EVALUATION OF LIPOPROTEIN A LEVELS IN SUBJECTS WITH CORONARY HEART DISEASE

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ABSTRACT **Background:** Cardiovascular disease (CVD) is the leading cause of morbidity and mortality worldwide, accounting for nearly 30% of the total deaths based on the World Health Organization (WHO) statistics. The WHO reported that about 17.3 million people have died of CVD in 2016 and that this number will reach up to 23.3 million by 2030. **Objectives of the Study:** The objectives of the present study are to estimate and compare the levels of lipid profile parameters and lipoprotein a in subjects with and without coronary heart disease. **Methodology:** We included a total of 200 subjects in our case-control control study. Out of which 100 were controls and 100 were cases. Case: subjects with coronary artery disease (CAD) and Controls: subjects without coronary artery disease (CAD). We evaluated lipoprotein a, lipid profile (total cholesterol, triglycerides (TAG), high density lipoproteins (HDL), low density lipoproteins levels (LDL) and very low density lipoproteins (VLDL) in these subjects. After informed consent fasting blood sample was collected from both cases and controls and estimated lipoprotein a and lipid profile parameters. Statistical analysis was done using Microsoft Excel spreadsheet, and statistical package for the social sciences (SPSS) version 20.0 software. Statistical significance was assessed using student t test and the value of p was calculated. A p value <0.05 is considered statistically significant. **Results:** Table 1 presents the comparison of demographic, clinical and behavioral characteristics between cases and controls. It is evident that the number of subjects in control group aged <= 50 years were 30 and > 50 years were 70 and in cases 17 and 83 respectively which is statistically significant. The number of females and males in control and case group were 36, 64, 28 and 72 respectively. The mean and SD of BMI was significantly elevated in cases compared to control group. The waist hip ratio was increased in cases compared to control but it was not statistically significant. There were increased number of subjects with diabetes, hypertension, dyslipidemia, tobacco consumption and alcohol consumption in cases compared to control group, which were statistically significant except for dyslipidemia.Table 2 presents lipid profile and lipoprotein a level between cases and controls. It is evident that total cholesterol, triglycerides, high density lipoproteins, low density lipoproteins, and lipoprotein a level are elevated in cases compared to controls, which is statistically significant (p <0.05). **Discussion and Conclusion:** The findings of our study concluded that there are elevated levels of lipoprotein a, lipid profile parameters are deranged in subject with coronary artery disease as compared to controls. The various risk factors include tobacco consumption, alcohol intake, diabetes, hypertension, and dyslipidemia. Lifestyle modification, and regular monitoring of blood pressure and glycemic control play an important role in CAD prevention. Lipoprotein a screening test to be performed in all the subjects with these risk factors on regular basis along with basic lipid profile test.

KEYWORDS : lipoprotein a, coronary artery disease, lipid profile parameters, diabetes & hypertension

INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of morbidity and mortality worldwide, accounting for nearly 30% of the total deaths based on the World Health Organization (WHO) statistics. The WHO reported that about 17.3 million people have died of CVD in 2016 and that this number will reach up to 23.3 million by 2030 [1]. Currently, pharmacological therapies including antiplatelet agents, angiotensin-converting enzyme inhibitors/angiotensin receptor blockers, beta-blockers and lipid-lowering drugs play a crucial role in the secondary prevention of CVD [2,3,4]. However, a residual CVD risk remains, for which further management needs to be identified.

Numerous studies have demonstrated the role of the lipid profile in the progression of CVD. Increases in triglyceride (TG) and total cholesterol (TC) levels could affect the constriction and abstraction of vessels in the heart, which are significantly correlated with the risk of CVD [5]. Moreover, increases in the low-density lipoprotein cholesterol (LDL-C) level could induce arteriosclerosis owing to accumulation of LDL-C in the intima-media of the artery, which could then promote thrombocytopoiesis [6]. However, the CVD risk might be reduced in persons with increased high-density lipoprotein cholesterol (HDL-C) levels. Therefore, individuals with high HDL-C and low non-HDL-C may be protected against the risk of CVD.

According to the guidelines of the American Heart Association, the following values are prescribed for the above-mentioned risk factors for cardiovascular disease: total cholesterol: <200 mg/dL; triglycerides: <200 mg/dL; HDL: >40 mg/dL; and LDL: <130 mg/dL [7].

The term cardiovascular diseases are a group of disorders of the heart or blood vessels, and include mainly ischemic heart disease, rheumatic heart disease and cerebrovascular disease or strokes. The lipid profile is a group of tests that are often done together to identify the risk of heart disease. These tests are good indicators of whether someone is likely to have a heart attack or stroke caused by the blockage of blood vessels or hardening of the arteries. The lipid profile usually includes: high levels of cholesterol in blood circulation are strongly associated with progression of heart disease. For a person of about 68 kg typical total blood cholesterol synthesis is about 1g (1000mg) per day [8,9].

Previous studies have published a robust association between Lp(a) and CVD outcomes in the general population. A wealth of current evidence suggests that an increased Lp(a) level is associated with a modest increase in the risk of future CVD events in both general and high-risk populations. Such an association of Lp(a) with CVD, is independent of LDL, reduced high-density lipoproteins (HDL), and other traditional CVD risk factors [7,8].

Lp(a) is uninfluenced by age, sex, diet, or environmental factors, with stable lifelong levels being attained by age of two. Lp(a) levels have shown worldwide ethnic variation with different levels associated with CAD in different populations. Over the last 50 years from when it was first discovered by Norwegian physician Kaare Berg, Lp(a) has evolved from an antigenic determinant in blood type to the strongest genetically determined risk factor for coronary artery disease [7,8,9]. Hence we have taken up this study to evaluate lipid profile parameters and lipoprotein a level in our subjects with and without CAD.

OBJECTIVES OF THE STUDY

The objectives of the present study are to estimate and compare the levels of lipid profile parameters and lipoprotein a in subjects with and without coronary heart disease.

METHODOLOGY:

Site: This study was conducted at the Department of Biochemistry.
Study population: Subjects suffering from CAD were included as cases and subjects without CAD were included as controls.
Study design: We conducted a Case-control study from January 2021

to December 2021.

Sample size: We included a total of 200 subjects, 100 cases and 100 controls.

Inclusion criteria: patients with and without CAD are included as cases and controls in our study. Cases with history of angina or surviving myocardial infarction with or without DM and HTN, admitted and diagnosed in coronary care unit.

Exclusion criteria: CHD cases with liver impairment, renal disease or thyroid disease were not included in the study.

This study was initiated after obtaining consent from the patients and healthy volunteers and after a prior approval by the Institutional ethical committee clearance.

Blood sample collection and biochemical analysis: Lipoprotein(a) assay: Pre-operative blood samples were collected in to plain tubes. Serum was separated (3500 rpm, 5–10 min) and Lp(a) content was measured by immunoturbidimetric method (Thermo Scientific, Finland). Lipoprotein(a) calibrator and control (Thermo Scientific, Finland) were used for calibration. A specific anti serum (5 µL of anti-human Lp(a) from rabbit, NaN_3 and NaCl) was added to buffered (140 µL; phosphate buffer saline) serum (24 µL), mixed and incubated at 37 °C. The absorbance of the immune-complex, produced from Lp(a) and anti-serum was measured at 340 nm (Konelab 20XT). The absorbance was considered proportional to the concentration of Lp(a). Lipid profile parameters were estimated by enzymatic method using automated biochemistry analyser.

Statistical Analysis: Statistical analysis was done using Microsoft Excel spreadsheet, and statistical package for the social sciences (SPSS) version 20.0 software. Statistical significance was assessed using student t test and the value of p was calculated. A p value <0.05 is considered statistically significant.

RESULTS: We included a total of 200 subjects in our case-control control study. Out of which 100 were controls and 100 were cases. Case: subjects with coronary artery disease (CAD) and Controls: subjects without coronary artery disease (CAD). We evaluated lipoprotein a, lipid profile (total cholesterol, triglycerides (TAG), high density lipoproteins (HDL), low density lipoproteins levels (LDL) and very low density lipoproteins (VLDL) in these subjects.

Table 1: Shows comparison of demographic, clinical and behavioral characteristics between cases and controls

Characteristics	Controls	Cases
Age group		
<=50 years	30	17
>50 years	70	83
Gender		
Female	36	28
Male	64	72
BMI	22.6 ± 2.2	28.2 ± 2.53
Waist Hip Ratio	0.89 ± 0.08	0.92 ± 0.09
Hypertension	21	68
Dyslipidemia	24	26
Tobacco user	16	49
Alcohol consumption	22	68

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Table 2: Shows comparison of lipid profile and lipoprotein a level between cases and controls

Characteristics	Controls	Cases
Total cholesterol	159.21±22.07	249.21±18.07
Triglycerides	156.21±13.07	236.21±16.07
High density lipoprotein	58.2±8.07	44.2±5.07
Low density lipoprotein	98.6±14.7	176.9±17.6
Lipoprotein a	26.9±5.07	48.9±8.07

Table 2 presents lipid profile and lipoprotein a level between cases and controls. It is evident that total cholesterol, triglycerides, high density lipoproteins, low density lipoproteins, and lipoprotein a level are elevated in cases compared to controls, which is statistically significant ($p < 0.05$).

DISCUSSION:

We included a total of 200 subjects in our case-control control study. Out of which 100 were controls and 100 were cases. Case: subjects with coronary artery disease (CAD) and Controls: subjects without coronary artery disease (CAD). We evaluated lipoprotein a, lipid profile (total cholesterol, triglycerides (TAG), high density lipoproteins (HDL), low density lipoproteins levels (LDL) and very low density lipoproteins (VLDL) in these subjects.

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In developed countries like the United States, although there has been a very significant decrease in the incidence of vascular diseases like CHD1 cerebrovascular disease, and peripheral vascular diseases, yet CHD remains to be the major cause of death. The major risk factors are elevated LDL-C, reduced HDL-C, smoking, hypertension, insulin resistance with or without overt diabetes mellitus, age, and family history of premature CHD. Modifiable risk factors account for 85% of the elevated CHD risk, of which the most important is plasma cholesterol. TC levels of <160 mg/ dl is able to decrease CHD risk, even if other risk factors are present.

The key role of cholesterol in CHD has given rise to the universally accepted cholesterol-diet-CHD hypothesis. According to this hypothesis, increased plasma cholesterol concentrations increase the risk of CHD and decreasing plasma cholesterol levels decreases the risk of CHD. The Multiple Risk Factor Intervention Trial (MRFIT) showed that there is an increased risk at levels >200 mg/dL. The Seven Countries Study also demonstrated that elevated plasma cholesterol levels increased the incidence of CHD. The Framingham study clearly demonstrated the association of elevated cholesterol with CHD.

Epidemiologic studies have linked the intake of high levels of dietary fat rich in cholesterol and saturated fats, with in- creased plasma cholesterol levels. Therefore, restriction of saturated fat and cholesterol is the cornerstone of dietary therapy to lower down the elevated blood cholesterol levels. Despite the wide literature on the relationship between lipid and lipoprotein particles to CHD incidence, there has been controversial evidence on the specific association of TAG with CHD.

According to two meta-analyses, TAGs were independent risk factors for CHD, even after adjustment with HDL-C, which is strongly and invers Another recent prospective cohort study of apparently healthy male physicians demonstrated that an increase in HDL-C of ≥12.5 mg/dl over 14 years was associated with a 57% lesser risk of developing CHD. However, according to major clinical guidelines, HDL-C is a secondary target in CHD prevention. Current guidelines from the Adult Treatment Panel III emphasize on targeting primarily LDL-C, secondarily non–HDL-C, and then HDL-C. According to the American Diabetes Association, HDL-C should be considered a "secondary target" along with TAG, with a goal of HDL-C levels >40 mg/dL. The recent American Heart Association / National Heart, Lung, and Blood Institute scientific statement proposes that HDL-C

should be a "tertiary target", following LDL-C and TAG, with goals of HDL-C levels >40 mg/dl in men and >50 mg/ dl in women.

The importance of LDL-C in the pathogenesis of CHD is well documented, and so is the benefit of lowering LDL in high- risk patients. This study demonstrated a significant increase in LDL-C in the CHD group. The National Cholesterol Education Program (NCEP) recommends an LDL-C goal of <100 mg/dl in patients with established CHD and in those who are CHD risk-equivalent. Aggressive LDL-C reduction is associated with less atherosclerosis progression, lower rates of revascularization, and fewer ischemic events compared with moderate LDL-C reduction or conventional treatment [13, 14, 15, 16].

CONCLUSION

The findings of our study concluded that there are elevated levels of lipoprotein a, lipid profile parameters are deranged in subject with coronary artery disease as compared to controls. The various risk factors include tobacco consumption, alcohol intake, diabetes, hypertension, and dyslipidemia.

Lifestyle modification, and regular monitoring of blood pressure and glycemic control play an important role in CAD prevention.

Lipoprotein a screening test to be performed in all the subjects with these risk factors on regular basis along with basic lipid profile test.

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