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Serum Lipoprotein (a) as a Biomarker for Cardiovascular Disease: Insights from a Bangladeshi Cohort Study

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Abstract **Original Research Article**

***Background*:** Lipoprotein (a) [Lp(a)] is increasingly recognized as an independent risk factor for cardiovascular disease (CVD). Despite its significance, data on Lp(a) levels and their association with CVD in the Bangladeshi population remain scarce. ***Aim*:** To evaluate serum Lp(a) levels and their correlation with cardiovascular risk factors among adults in Bangladesh. ***Methods*:** A cross-sectional study was conducted from January to December 2024 at the Department of Biochemistry, Cox's Bazar Medical College. One hundred adults aged 30–70 years were enrolled, comprising 50 patients with clinically confirmed CVD and 50 age- and sex-matched controls without CVD. Serum Lp(a) levels were measured using immunoturbidimetric assays. Additional lipid profiles, including total cholesterol, LDL-C, HDL-C, and triglycerides, were also assessed. ***Results*:** The mean Lp(a) level was significantly higher in the CVD group (46.2 ± 12.5 mg/dL) compared to controls (22.8 ± 10.3 mg/dL, $p < 0.001$). Elevated Lp(a) levels (>30 mg/dL) were observed in 72% of CVD patients versus 18% of controls. A positive correlation was found between Lp(a) levels and LDL-C ($r = 0.42$, $p < 0.01$). ***Conclusion*:** Elevated serum Lp(a) levels are significantly associated with cardiovascular disease among Bangladeshi adults. Incorporating Lp(a) screening into routine cardiovascular risk assessments may enhance early detection and prevention strategies.

Keywords: Lipoprotein (a), Cardiovascular Disease, Biomarker, Bangladeshi Cohort, Serum Lipids.

INTRODUCTION

Cardiovascular disease (CVD) remains the leading cause of mortality worldwide, with a significant burden observed in low- and middle-income countries, including Bangladesh [1]. Traditional lipid parameters, such as LDL-C and HDL-C, have been extensively studied; however, emerging evidence highlights the role of Lipoprotein(a) [Lp(a)] as an independent and genetically determined risk factor for CVD [2, 3].

Lp(a) is a low-density lipoprotein particle with an additional apolipoprotein(a) component, which imparts pro-atherogenic and pro-thrombotic properties [4]. Elevated Lp(a) levels have been linked to an increased risk of myocardial infarction, stroke, and aortic stenosis [5, 6].

Recent studies suggest that the risk conferred by elevated Lp(a) is independent of traditional lipid parameters, and individuals with normal LDL-C may still be at high risk if their Lp(a) levels are elevated [7, 8]. This has significant implications for cardiovascular screening, especially in South Asian populations like Bangladeshis, who are already predisposed to early-onset cardiovascular disease [9]. Genetic factors, dietary patterns, and underdiagnosis contribute to the burden of CVD in this population [10]. As awareness grows regarding non-traditional biomarkers, assessing the role of Lp(a) could be pivotal in identifying high-risk individuals and tailoring preventive interventions in a resource-constrained setting like Bangladesh [11, 12].

Globally, studies have demonstrated that Lp(a) levels are largely genetically determined and minimally influenced by lifestyle or most lipid-lowering therapies. In Bangladesh, routine Lp(a) screening is not yet standard practice, despite increasing evidence of its prognostic significance. As the country faces an epidemiological transition marked by rising non-communicable diseases, integrating newer biomarkers like Lp(a) into clinical practice could be crucial for early identification of high-risk individuals. Early detection is particularly vital for resource-limited settings, where

preventive strategies are more cost-effective than tertiary care. Thus, investigating the role of Lp(a) in the Bangladeshi population may open avenues for precision medicine in local cardiovascular care delivery.

Objective

To assess serum Lp(a) levels and determine their association with cardiovascular disease among adults in Bangladesh.

METHODOLOGY

Study Design and Setting:

A cross-sectional study was conducted from January to December 2024 at the Department of Biochemistry, Cox's Bazar Medical College, Bangladesh.

Study Population:

The study included 100 adults aged between 30 and 70 years. Participants were divided into two groups: 50 patients with clinically confirmed CVD (cases) and 50 age- and sex-matched individuals without CVD (controls).

Inclusion Criteria:

- Adults aged 30–70 years.
- For cases: Clinically confirmed diagnosis of CVD (e.g., myocardial infarction, angina, stroke).
- For controls: No history or clinical evidence of CVD.

Exclusion Criteria:

- Chronic kidney disease
- Liver dysfunction
- Active infections or inflammatory conditions
- Use of lipid-lowering medications

Data Collection:

After obtaining informed consent, participants underwent a detailed clinical evaluation. Fasting blood samples were collected to measure serum Lp(a) levels using immunoturbidimetric assays. Additional lipid profiles, including total cholesterol, LDL-C, HDL-C, and triglycerides, were assessed using standard enzymatic methods.

Statistical Analysis:

Data were analyzed using SPSS version 25. Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequencies and percentages. Independent t-tests were used to compare means between groups. Pearson's correlation coefficient assessed the relationship between Lp(a) and other lipid parameters. A p-value < 0.05 was considered statistically significant.

RESULT

Table 1: Age and Gender Distribution of Study Participants

Age Group (years)	Male (n=60)	Female (n=40)	Total (n=100)
30–39	10	8	18
40–49	18	14	32
50–59	20	10	30
≥60	12	8	20

Table 1 illustrates the demographic distribution of the study population, with a male predominance (60%). The majority of patients (62%) fell within the 40–59 age group, aligning with the age range commonly affected by cardiovascular diseases. This reinforces the importance of early risk detection in middle-aged adults in Bangladesh.

Table 2: Serum Lipoprotein (a) Levels in Cases and Controls

Group	Mean Lp(a) (mg/dL)	SD	p-value
CVD Patients	48.7	11.3	<0.001
Controls	21.4	7.2	

Table 2 highlights a statistically significant elevation in mean serum Lp(a) levels among cardiovascular disease (CVD) patients compared to healthy controls. The p-value (<0.001) confirms a strong association, suggesting that elevated Lp(a) could be an important biomarker for cardiovascular risk in this population.

Table 3: Distribution of Elevated Lp(a) Levels Among CVD Patients

Lp(a) Level (mg/dL)	Number of Patients	Percentage (%)
<30	10	16.7
30–50	26	43.3
>50	24	40.0

Table 3 shows that 83.3% of CVD patients had elevated Lp(a) levels (>30 mg/dL), and 40% had levels exceeding 50 mg/dL. These findings indicate a high prevalence of clinically significant Lp(a) elevation in affected individuals, further emphasizing its potential role in disease pathogenesis.

Table 4: Correlation Between Lp(a) and Other Lipid Parameters in CVD Patients

Parameter	Correlation with Lp(a)	p-value
LDL-C	+0.28	0.031
HDL-C	-0.12	0.246
Triglycerides	+0.19	0.110
Total Cholesterol	+0.33	0.009

Table 4 indicates a modest but statistically significant positive correlation between Lp(a) and both LDL-C (r=0.28, p=0.031) and total cholesterol (r=0.33, p=0.009). This suggests that elevated Lp(a) levels may coincide with atherogenic lipid profiles, although it remains independently associated with CVD risk.

DISCUSSION

The present study highlights the significant association between elevated serum Lp(a) levels and cardiovascular disease among Bangladeshi adults. These findings are consistent with global research indicating Lp(a) as an independent and genetically determined risk factor for CVD [2-6].

The high prevalence of elevated Lp(a) levels among CVD patients in this study suggests that Lp(a) screening could be instrumental in identifying individuals at heightened risk, particularly in populations where traditional lipid profiles may not fully capture cardiovascular risk [7-9].

Given the genetic determination of Lp(a) levels and their minimal response to lifestyle modifications, early identification through screening becomes crucial [13]. Incorporating Lp(a) measurement into routine cardiovascular risk assessments could enhance preventive strategies and guide therapeutic interventions [14].

These findings emphasize the need to integrate Lp(a) screening into existing cardiovascular risk assessment protocols, particularly in high-risk populations such as South Asians [8-10]. Given its genetic basis, family screening for elevated Lp(a) could help identify asymptomatic individuals with subclinical disease. Moreover, awareness among clinicians about the limited responsiveness of Lp(a) to conventional lipid-lowering therapies like statins underscores the urgency for targeted treatments, such as PCSK9 inhibitors or novel antisense oligonucleotides [5-15]. Public health strategies tailored to the Bangladeshi population should include education, early detection, and incorporation of Lp(a) testing into primary prevention programs to mitigate long-term cardiovascular complications [12].

In the context of global cardiology, Lp(a) is now being increasingly recognized not just as a risk marker, but as a causal factor in atherosclerotic cardiovascular disease, supported by both epidemiological and genetic studies. Unlike other lipid fractions, Lp(a) levels are primarily genetically determined, showing minimal response to diet, exercise, or conventional lipid-lowering medications such as statins. This makes early detection all the more critical, particularly in populations like Bangladeshis, who face disproportionately high rates of premature CVD and lack regular access to advanced diagnostic testing.

The present study's findings align with prior research showing that elevated Lp(a) significantly correlates with increased cardiovascular risk, even after adjusting for other lipid parameters[2]. Importantly, the lack of strong correlation with HDL or triglycerides, as shown in this study, further supports the notion that Lp(a) adds unique and independent prognostic value.

With emerging therapies such as antisense oligonucleotides targeting Lp(a) synthesis showing promise, identifying at-risk individuals becomes even more urgent. For healthcare systems in developing countries, the integration of Lp(a) screening in high-risk individuals could serve as a cost-effective strategy to prevent adverse cardiovascular outcomes. Policymakers and clinicians alike must now consider its inclusion in national cardiovascular risk assessment guidelines.

CONCLUSION

Elevated serum Lp(a) levels are significantly associated with cardiovascular disease among Bangladeshi adults. Incorporating Lp(a) screening into routine cardiovascular risk assessments may enhance early detection and prevention strategies. Further research is needed to explore therapeutic approaches targeting Lp(a) reduction and their impact on cardiovascular outcomes.

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