

**Original research article**

# Analysis of lipoprotein (a) levels in patients with acute coronary syndrome: A comparison of type 2 diabetes and non-diabetics

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## Abstract

**Background:** There has been a substantial rise in the incidence of cardiovascular disease in recent decades. Coronary artery disease (CAD) may have a genetic or environmental origin, or the two may be related.

**Material and Methods:** Using demographic and sex matching, from the total 88 patients, 44 patients with type 2 diabetes and 44 are the non-diabetic were selected from hospitalized patients with acute coronary syndrome. The patients' lipoprotein (a) levels were analyzed. Patients hospitalized with acute coronary syndrome to the cardiac ICU at the Gandhi Hospital, during the study period July 2022 to November 2022.

**Results:** Heart disease is the major cause of death among those who have diabetes mellitus. According to the Framingham Heart Study, those with diabetes had a 1-5 times higher risk of coronary artery disease, acute myocardial infarction, and sudden death. Therefore, the prognosis for diabetic individuals with CAD is worse than that of people without diabetes. There are a number of complications that can arise in patients with diabetes, including early thrombus formation, smooth muscle proliferation, endothelial dysfunction, and platelet dysfunction.

**Conclusion:** Lp(a) levels are greater in patients with type 2 diabetes during acute coronary syndrome compared to patients without diabetes. Compared to the general population, patients with type 2 diabetes are about twice as likely to have abnormally high levels of Lp(a).

**Keywords:** Lipoprotein, acute coronary syndrome, type 2 diabetes, non-diabetics

## Introduction

The prevalence of cardiovascular disease has skyrocketed during the past several decades. Both genetic and environmental factors have been implicated in the development of coronary artery disease (CAD), while the latter may only be a contributing factor. Assessment of lipoproteins in the laboratory is crucial for the diagnosis and treatment of atherosclerosis <sup>[1-3]</sup> due to the role that changes in lipid metabolism play in the disease's progression.

High levels of lipoprotein (a), commonly known as Lp (a), are associated with an increased risk of developing coronary artery disease at a younger age. Berg identified lipoprotein (a) in 1963 as a subtype of low-density lipoprotein (LDL). LDL has a variant called lipoprotein (a). Apolipoprotein (a), often known as Apo(a), is connected to apolipoprotein B by disulfide bridges <sup>[4, 5]</sup>. Although Lp(a) and LDL share a similar lipid composition, the protein level is very different due to the presence of Apo(a). A person's molecular mass of Apo (a) and their blood levels of Lp (a) are both strongly impacted by their genetic makeup. Lack of Lp(a) in the serum does not lead to metabolic problems since it is not involved in lipid transport. Apo (a) is highly similar to plasminogen, the inactive precursor of plasmin, the protein responsible for dissolving fibrin during the coagulation process, due to the presence of several repeats of amino acid sequences that are identical to plasminogen's kringle region. Lp(a)'s structure allows it to bind to fibrin and the proteins found on the surfaces of endothelial cells and monocytes <sup>[6, 7]</sup>. In addition to suppressing plasmin and fibrinolysis, Lp(a) can inhibit t-PA via competitive inhibition. Lp(a) has these features, which is why it is linked to an increased risk of developing early-onset CAD, cerebrovascular illness, and restenosis of coronary lesions. Atherosclerosis in the coronary arteries and the cerebral arteries may be influenced by Lp (a), as has been suggested in a number of studies. More than 60% of CAD in Indians cannot be accounted for by traditional risk factors, illustrating the importance of new cardiovascular risk factors. New risk variables like lipoprotein (a), C-reactive protein (CRP), and homocysteine were found to be significantly higher in Indians compared to other groups <sup>[8, 9]</sup>. Indians

consistently have the highest levels of lipoprotein (a) compared to other groups. More than three times as many people with type 2 DM (diabetes mellitus) will also develop coronary artery disease (CAD), generally known as atherosclerosis. Hypertension, lipid abnormalities, central obesity, and glucose intolerance all contribute to an increased cardiovascular risk, but only to a limited extent. Even in the presence of additional risk factors for coronary artery disease (CAD), a high level of lipoprotein (a) (Lp(a)) is prevalent. Contradictory findings have been found in research examining the link between blood Lp(a) levels and diabetes [10]. Some study found an elevated level of serum Lp (a) in patients whose diabetes was not under control, whereas others did not. However, research has shown that cholesterol levels in both male and female diabetics are predictive of coronary heart disease. Serum levels of Lp(a) were examined between patients with type 2 diabetes and healthy controls in this study [9-11].

The purpose of the study was to examine the association between elevated lipoprotein (a) levels and type 2 diabetes, as well as between elevated lipoprotein (a) levels and Acute Coronary Syndrome in both diabetics and non-diabetics. Whether or not the levels of lipoprotein (a) in patients with type 2 diabetes are higher than in the general population.

### Methodology

Using demographic and sex matching, from the total 88 patients, 44 patients with type 2 diabetes and 44 are the non-diabetic were selected from hospitalized patients with acute coronary syndrome. The patients' lipoprotein (a) levels were analyzed. Patients hospitalized with acute coronary syndrome to the cardiac ICU Gandhi Hospital during the study period July 2022 to November 2022.

### Inclusion Criteria

1. Patients with angina that started within 24 hours of the beginning of angina and lasted more than 30 minutes when at rest were included in the trial.
2. 44 of the patients were type 2 diabetics.
3. The other group included 44 non-diabetic patients as well.
4. Blood glucose levels were measured fasting and two hours after eating to rule out diabetes in the non-diabetic group.

### Exclusion Criteria

1. Severe thyroid dysfunction.
2. Medical history of oral contraceptive use.
3. Type 1 diabetes.
4. Kidney failure.

88 patients with acute coronary syndrome, who met the inclusion and exclusion criteria during the study period, were split into two groups, those with type 2 diabetes mellitus and those without, based on age and gender. The procedure called for a comprehensive evaluation of each patient's medical history and physical, including the collection of relevant laboratory and imaging data. This group has been diagnosed with type 2 diabetes. By comparing fasting and postprandial blood glucose levels, the GOD-POD method was utilized to rule out diabetes mellitus in the non-diabetic group.

### Results

Heart disease is the major cause of death among those who have diabetes mellitus. According to the Framingham Heart Study, those with diabetes had a 1-5 times higher risk of coronary artery disease, acute myocardial infarction, and sudden death. Therefore, the prognosis for diabetic individuals with CAD is worse than that of people without diabetes. There are a number of complications that can arise in patients with diabetes, including early thrombus formation, smooth muscle proliferation, endothelial dysfunction and platelet dysfunction.

**Table 1:** Cases are distributed by age and gender

Sr. No.	Age	Diabetic			Nondiabetic		
		Male	Female	Total	Male	Female	Total
1	21 to 30	3	0	3	3	0	3
2	31 to 40	6	3	9	3	1	4
3	41 to 50	4	5	9	4	7	11
4	51 to 60	4	10	14	7	5	12
5	61 to 70	3	4	7	1	8	9
6	71 to 80	1	0	1	2	1	3
7	81 to 90	1	0	1	2	0	2
		22	22	44	22	22	44

The accompanying table demonstrate that the prevalence of disease is highest in women aged 51-60, among diabetic patients. Prevalence is higher among men aged 51-60 among non-diabetics.

**Table 2:** Diabetic lipoprotein (a) levels with age

Sr. No.	LP (a) levels	Age in years					
		21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	>71
1	0 to 15	1	2	1	4	2	1
2	16 to 30	1	5	2	5	3	1
3	31 to 45	1	2	3	4	2	0
4	46 to 60	0	0	3	1	0	0
	Total	3	9	9	14	7	2

**Table 3:** Non-diabetic Lp(a) distribution by age

Sr. No.	Lp (a) Levels	Age in years					
		21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	>71
1.	0 to 15	2	4	7	9	8	5
2.	16 to 30	1	0	3	1	1	0
3.	31 to 45	0	0	1	1	0	0
4.	46 to 60	0	0	0	1	0	0
	Total	3	4	11	12	9	5

#### Diabetic and non-diabetic Lp(A) levels

There is a statistically significant disparity between the groups' median serum Lp(a) levels. The Lp(a) levels of individuals with type 2 diabetes were higher than those of patients without diabetes who had acute coronary syndrome.

#### Diabetic and non-diabetic LDL levels compared

Diabetics have significantly greater serum LDL levels compared to those without diabetes.

#### Discussion

In recent years, there has been a dramatic rise in the incidence of coronary artery disease among Asian Indians. However, the reasons for the coronary artery disease among Asian Indians compared to Caucasians remain unknown. A hereditary predisposition to heart disease in Asian Indians becomes a more reasonable theory when traditional risk factors fail to provide an explanation. Given that lipoprotein (a) is known to be hereditary, studying its levels is crucial. Since south Asians have been reported to have the highest Lp(a) concentrations in most studies, it is crucial to remember that Lp(a) values fluctuate across different races. This is shown by the work of Enas *et al.* The current analysis confirmed previous findings<sup>[11, 12]</sup> that Lp(a) levels are also significantly higher in our cohort.

Heart disease is the major cause of death among those who have diabetes mellitus. According to the Framingham Heart Study, those with diabetes had a 1-5 times higher risk of coronary artery disease, acute myocardial infarction, and sudden death. Therefore, the prognosis for diabetic individuals with CAD is worse than that of people without diabetes. People with diabetes are at an increased risk for complications such as thrombus development, smooth muscle proliferation, endothelial dysfunction, and platelet dysfunction<sup>[13]</sup>.

Patients with acute coronary syndrome were split evenly between those with and without diabetes in this study. Serum Lp(a) was one of many indicators used to assess differences between the two groups. Patients admitted to the cardiology ICU at Gandhi hospital with acute coronary syndrome between July 2022 and November 2022 were randomly split into two groups. Because to the careful matching of ages and sexes, each group contains the same amount of participants. The clinical profile was analyzed using data from multiple research<sup>[14, 15]</sup>.

Except for a study by Mohan *et al.*, which is of a similar age, the mean age of the cases studied here is younger than those in other studies. Ariyo *et al.* in the suggested that men over the age of 60 had an increased risk of stroke, death from vascular disease, and death from all causes, but women of the same age or older did not. The average age of the participants in this study is under 60 years old, therefore the effects of aging are small<sup>[16-18]</sup>.

The mean age of the current study's participants is in the early 50s, which is in line with the findings of Mohan *et al.* One possible explanation is that people in South India experience Acute Coronary Syndrome at a younger age than those in the West. Serum After menopause, Lp (a) levels shift. This held true for those with and without diabetes. Which is known to increase the risk of atherothrombosis and lower Lp (a) levels<sup>[17-19]</sup>.

In this study, Lp (a) values varied from 7mg/dl to 60mg/dl. Type 2 diabetics have greater Lp (a) levels than the general population. The difference in means was statistically significant. Similar findings were found by Mohan *et al.*, Neki *et al.*, and Salehi *et al.* Similar serum Lp (a) measurements were taken from the same cohort of patients [19, 20].

Lp (a) > 15mg/dl was found in 80% of those with type 2 diabetes, but only 20% of people without diabetes. Type 2 diabetics are nearly twice as likely as non-diabetics to have increased serum lipoprotein(a) in the context of an acute coronary syndrome. Serum total cholesterol, LDL level, triglyceride, and Lp(a) levels were all shown to be greater in the diabetes group compared to the non-diabetic groups. HDL levels are drastically lower in the diabetic population than in the general population. In this study, researchers observed that serum Lp(a) levels were positively and modestly associated with both total and LDL cholesterol. This jived with the findings of Mohan and colleagues. Having a high Lp(a) level is associated with an even higher risk of developing coronary artery disease in those with type 2 diabetes [20-22].

Communities with both high Lp(a) and LDL levels may have a hereditary propensity to cardiovascular disease. Patients with diabetes had a higher mortality rate after suffering an acute myocardial infarction. Conclusions cannot be taken with certainty from the present investigation because it is a cross-sectional study with a relatively small sample size [23, 24].

In the current investigation, two people with diabetes died suddenly from secondary ventricular fibrillation. One person without diabetes went into cardiac arrest owing to persistent ventricular tachycardia but survived. According to a study by McGuire *et al.*, people with type 2 diabetes have a higher risk of dying from any cause, having a heart attack, having a stroke, or developing congestive heart failure after experiencing an acute coronary syndrome. In addition, in the diabetic population, women were at a far greater risk than men. Surprisingly, those with diabetes who had no history of cardiovascular disease had the similar event rates for all outcomes as people without diabetes who had a history of vascular illness [23-25].

### Conclusion

Patients with type 2 diabetes have higher Lp (a) levels compared to those without diabetes and are more likely to experience an acute coronary syndrome. People with type 2 diabetes are roughly twice as likely to have a high Lp (a) level as those without diabetes. Elevated Lp (a) in patients with type 2 diabetes exacerbates the predisposing atherogenic/prothrombotic state that leads to major adverse cardiac events.

**Conflict of Interest:** None.

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