Section: Cardiology

Original Research Article

STUDY OF LIPO-PROTEIN-(a) LEVELS AND SEVERITY OF CORONARY ARTERY DISEASE IN YOUNG ACUTE CORONARY SYNDROME PATIENTS AT TERTIARY CARE HOSPITAL

Venkateswara Rao. K[1], Punugupati Mahesh[2], Durga Prasad. S[3], Sk. Chinna Mastan[4], A. Vinaya Kishore[4], B. Roja[4], B. Nalini[4], CH. Chandrakala Seetha Rama Lakshmi[4]

[1]*Associate Professor, Department of Cardiology, Government Medical College, Ongole, Andhra Pradesh, India.*
[2]*Assistant Professor, Department of Cardiology, Government Medical College, Ongole, Andhra Pradesh, India.*
[3]*Associate Professor, Department of General Medicine, Government Medical College, Ongole, Andhra Pradesh, India.*
[4]*Pharm-D Student, QIS College of Pharmacy, Ongole, Andhra Pradesh, India.*

Received *: 20/04/2026*
Received in revised form *: 04/06/2026*
Accepted *: 21/06/2026*

Corresponding Author:
Dr.Venkateswara Rao. K,
Associate Professor, Department of Cardiology, Government Medical College, Ongole, Andhra Pradesh, India.
Email: kvrao5113@gmail.com

DOI:10.70034/ijmedph.2026.3.11

Source of Support: Nil,
Conflict of Interest: Nonedeclared

Int J Med Pub Health
2026; 16 (3); 65-73

ABSTRACT

Background: To study the relationship between lipoprotein(a) levels and severity of coronary artery disease in young patients with acute coronary syndrome at Tertiary Care Hospital.

Materials and Methods: The present study was conducted as a cross-sectional observational study to evaluate the association between Lipoprotein(a) levels and the severity of coronary artery disease in young patients with acute coronary syndrome. The study was carried out in the Department of Cardiology, Government General Hospital (GGH), Ongole. The study protocol was submitted to the Institutional Ethics Committee (IEC), Government General Hospital, Ongole. Approval was obtained before initiation of the study. Written informed consent was obtained from all participants (English and Telugu formats). The study was conducted over a period of 6 months. Patients aged less than 45 years who were diagnosed with Acute Coronary Syndrome (ACS) and admitted to the cardiology department were included in the study.

Results: The cross sectional study evaluated the relationship between Lipoprotein(a)[Lp(a)] levels and the severity of Coronary Artery Disease(CAD) in young patients presenting with Acute Coronary Syndrome(ACS). A total of 100 young ACS patients underwent clinical evaluation, measurement of Lp(a) levels, and coronary angiography. Disease severity was assessed using the SYNTAX score. Most patients were aged 36–40 years (33%), with a predominance of males (75%). Elevated Lp(a) levels (>30 mg/dL) were observed in 66% of patients, with a mean level of 52 mg/dL. Angiographic findings showed that single vessel disease was most common (58%), followed by double vessel disease (28%) and triple vessel disease (14%). The Left Anterior Descending (LAD) artery was the most frequently involved vessel. Based on SYNTAX scoring, 56% had low scores, 26% intermediate, and 18% high scores, with a mean score of 24. A significant positive correlation was found between Lp(a) levels and SYNTAX score ($r = 0.68$, $p < 0.001$), indicating increased CAD severity with higher Lp(a) levels.

Conclusion: These findings suggest that elevated Lipoprotein(a) is an important independent risk factor for premature CAD and may serve as a useful biomarker for risk assessment in young ACS patients.

Keywords: Acute coronary syndrome, CAD, Left Anterior Descending (LAD). Lipoprotein Lp(a), SYNTAX scoring.

INTRODUCTION

Globally, cardiovascular diseases represent an escalating public health challenge. As the leading cause of mortality worldwide, Cardiovascular diseases are responsible for approximately 17.9 million deaths annually.[1] Even with all the recent advancements in medical treatments and prevention, cardiovascular diseases are still a massive global problem. This creates a huge socioeconomic burden, especially when it affects younger people. When a patient under 45 gets Acute Coronary Syndrome, it is not just about the immediate hospital bills. It means they might miss out on years of work during their peak earning time, putting a lot of financial stress on their families while they also have to pay for lifelong medications. Because this problem is growing, we really need to find better ways to predict how severe the disease will be in young adults before it gets worse.[2]In the modern clinical management of cardiovascular disease, cardiac biomarkers serve as indispensable diagnostic tools.1,2,3 These measurable biological molecules are released into the systemic circulation in direct response to cardiac stress, structural injury, or functional impairment. Within the acute care setting, the rapid detection and precise quantification of these markers play a pivotal role in shaping every aspect of patient care from the initial diagnosis and acute risk stratification to long-term prognosis and therapeutic guidance across a wide spectrum of cardiovascular conditions.[2] Historically, the landscape of cardiac biomarkers was relatively narrow, relying primarily on traditional markers of gross myocardial necrosis. However, clinical pathology has witnessed a profound evolution in this field over recent decades. Today's diagnostic panel has expanded far beyond simple tissue death to include highly sophisticated indicators that reflect a complex array of underlying pathophysiological processes. Contemporary biomarkers can now actively quantify vascular inflammation, severe oxidative stress, acute hemodynamic stretch, and, crucially for this research, innate genetic predispositions to atherothrombosis.[2] This remarkable evolution has completely revolutionized the triage and management of acute cardiac events. The timely and accurate identification of Acute Coronary Syndromes (ACS), in particular, relies heavily on the rapid assessment of these targeted biochemical signals. When a patient presents to the emergency department with ambiguous chest pain, these biomarkers provide the definitive, objective data required to distinguish a lifethreatening acute myocardial infarction from other benign conditions with identical clinical presentations. Ultimately, they serve as the biological tie-breaker that dictates immediate, life-saving interventions.[4]

Risk Stratification in Acute Coronary Syndrome (ACS): When applied specifically to the ACS population, the SYNTAX score offers critical prognostic insights that extend far beyond what traditional cardiovascular risk factors can predict. By accurately quantifying the anatomical damage, it helps clinicians readily identify patients at the highest risk for future adverse events. Its application is particularly relevant in cases involving multi-vessel coronary artery disease (MVD), where a high score serves as a direct indicator of an extensive, heavy disease burden. Flagging these high-risk individuals is essential, as it identifies the exact patients who will benefit from far more aggressive medical therapy and highly tailored revascularization strategies.[1,11]

Knowledge Gaps in Regional Specificity (Ongole):

While the global medical community increasingly understands the role of highly proatherogenicLp(a) in driving premature heart disease and regulating the severity of angiographic lesions in CAD, a massive knowledge gap remains at the local level. We have guidelines from Europe and consensus statements from the national level, but specific, comprehensive data from localized regions like Ongole, India, is remarkably limited. We cannot simply take risk models built in Western nations, or even generalized pan-Indian statistics, and assume they perfectly reflect the patients walking into our local emergency rooms. There is a critical, immediate need for targeted, localized investigations right here in Ongole. We must understand the precise prevalence, the unique clinical characteristics, and the specific clinical implications of elevated Lp(a) levels specifically within our own young (≤45 years) ACS patient population. Conducting this research within our particular regional and ethnic context is not just an academic exercise; it is a clinical necessity. By investigating how this genetic marker behaves and dictates disease severity in our local hospitals, we are contributing invaluable, ground-level epidemiological data. This localized evidence is crucial for filling the regional knowledge gaps and adding a vital piece to the much broader puzzle of understanding, treating, and preventing cardiovascular disease in young South Asian adults.[1,7]

Beyond Revascularization Decisions

While the tool was originally conceived strictly to guide the choice between bypass surgery and stenting, its clinical utility has significantly expanded over the years. Today, the SYNTAX score is increasingly utilized for general cardiovascular risk stratification, serving as a highly objective, standardized measure of a patient's total atherosclerotic burden. Most importantly for this research, it provides a vital framework for understanding the overall severity and complexity of atherosclerosis specifically in young individuals presenting with ACS. By utilizing this score, we can mathematically translate the aggressive nature of premature CAD into measurable data, allowing us to evaluate exactly how independent, genetic risk factors influence physical disease progression.[8]

SYNTAX Score in Young ACS Patients and its Potential Interplay with Lipoprotein(a) Levels

Assessment in Young Adults:

Applying the SYNTAX score specifically to young ACS patients is a crucial clinical exercise. In this younger demographic, coronary artery disease frequently presents in a highly aggressive manner, often proving to be far more extensive and complex than initially perceived upon emergency admission. This aggressive presentation routinely occurs even in the complete absence of traditional cardiovascular risk factors, such as diabetes or long-term smoking. By utilizing the SYNTAX score, we can strip away age-related clinical bias and objectively quantify this heavy anatomical burden.[5]

Connecting Lp(a) and CAD Severity

The biological driver behind this severe, early-onset atherosclerosis is increasingly pointing toward genetics. Elevated Lipoprotein(a) levels are now firmly established as a causal and entirely independent risk factor for premature atherosclerotic cardiovascular disease (PCAD). Extensive studies have consistently indicated a direct correlation between circulating Lp(a) levels and the physical, angiographic severity of CAD. For instance, significantly higher Lp(a) concentrations have been directly associated with complex, multivessel coronary artery disease in young patients presenting with acute myocardial infarction (AMI). Furthermore, international research including extensive studies conducted within Vietnamese populations has rigorously evaluated the value of Lp(a) in predicting the exact severity of coronary artery stenosis in chronic CAD, further emphasizing this critical link across different Asian demographics.[8-10]

Hypothesized Relationship

Based on this compounding evidence, it is hypothesized that in young ACS patients particularly those harboring elevated Lp(a) levels but presenting with very few traditional risk factors the SYNTAX score will reveal a significantly greater extent and complexity of CAD. This strongly suggests that Lp(a) does not merely contribute to the initial, silent development of atherosclerosis, but actively drives the anatomical severity and physical spread of the disease. Furthermore, emerging clinical lipidology has proposed the non-Lp(a) apolipoprotein B to Lp(a) ratio as a novel metric for assessing this atherogenic risk. Specifically, a calculated ratio of ≤ 5 strongly suggests a significantly higher atherogenicity of the circulating Lp(a) particles, accelerating plaque formation.[11]

Justification for the Combined Study

This profound interplay forms the foundational justification for our research. Investigating the highly objective SYNTAX score in direct conjunction with Lp(a) levels in young ACS patients at Government General Hospital, Ongole, allows for a highly granular understanding of this disease. It provides a unique lens to observe exactly how a genetically determined risk factor physically influences the anatomical burden of CAD within our specific, highly vulnerable regional population. Ultimately, this integrated clinical approach will provide far deeper insights into disease pathogenesis and regional risk stratification, specifically for a young demographic where standard, traditional risk assessment tools consistently fall tragically short.[4]

Limitations and Future Directions: Integrating the SYNTAX Score and Lp(a)

Limitations of the SYNTAX Score

While the SYNTAX score remains the gold standard for mapping the physical extent of coronary disease, it is vital to acknowledge its inherent clinical limitations. Fundamentally, it is an exclusively *anatomical* scoring system. It evaluates the visual narrowing of the vessel but completely fails to account for the *physiological* severity of the lesion (such as whether blood flow is actually severely restricted, which is typically measured by Fractional Flow Reserve). Furthermore, it cannot assess underlying plaque characteristics or vulnerability. A patient might have a low SYNTAX score but possess highly unstable, rupture-prone plaques driven by intense lipid inflammation. Additionally, in a busy clinical setting like a government hospital, manually calculating the score is highly time-consuming and requires specialized training in interventional cardiology to ensure inter-observer reliability.

Bridging the Gap for Holistic Risk Assessment

Because the SYNTAX score only tells part of the story, relying on it in isolation is inadequate, particularly for highly vulnerable populations. By strategically combining this strict anatomical scoring system with profound biochemical markers like Lp(a), we can bridge this critical diagnostic gap. This integrated approach offers a truly holistic cardiovascular risk assessment. It merges the physical evidence of damage (SYNTAX) with the invisible, biological driver of that damage (Lp(a)). This dual assessment is especially pertinent for South Asian populations, who not only suffer a drastically higher baseline incidence of CVD but frequently exhibit genetically elevated Lp(a) levels that standard lipid panels miss.[3,17]

Paving the Way for Personalized Medicine

Ultimately, understanding the direct correlation between high Lp(a) concentrations and high SYNTAX scores in young ACS patients paves the way for a new era of personalized medicine. Identifying a young adult with a heavy anatomical burden driven by an unmodifiable genetic trait fundamentally alters their management. It shifts the clinical focus from standard care to highly aggressive, personalized treatment strategies.[2,9]

Most importantly, early identification through routine Lp(a) testing, paired with objective CAD severity assessment via the SYNTAX score, ensures these young, high-risk individuals are not lost in the system. It facilitates earlier, more intense lifestyle

and pharmacological interventions today, and perfectly positions these exact patients to receive novel, highly targeted Lp(a) lowering RNA therapies the moment they emerge from clinical trials.[16]

Need of Study

- Cardiovascular diseases continue to be the leading cause of death worldwide, with Acute Coronary Syndrome (ACS)playing a major role in contributing to this global health burden.
- In recent years, there has been a noticeable increase in the occurrence of Acute Coronary Syndrome (ACS) among young individuals under the age of 40.
- Many of these patients do not show the traditional cardiovascular risk factors, such as hypertension, diabetes mellitus, smoking, or dyslipidemia.
- Therefore, there is growing interest in identifying non-traditional biomarkers that could help in the early prediction and prevention of coronary artery disease.
- Lipoprotein(a) [Lp(a)] is a genetically determined lipoprotein particle that is structurally similar to low-density lipoprotein (LDL), but it contains an additional component called apolipoprotein(a).
- Elevated levels of Lipoprotein(a) [Lp(a)] have been linked to atherosclerosis, thrombosis, and endothelial dysfunction, all of which play a role in the development and progression of coronary artery disease.
- Several studies have shown that elevated Lipoprotein(a) [Lp(a)] levels are linked to a higher risk and greater severity of coronary artery disease, particularly in younger patients.
- However, the relationship between Lipoprotein(a) [Lp(a)]levels and the angiographic severity of coronary artery disease in young patients with acute coronary syndrome is still not clearly established in the Indian population.
- Evaluating this association may help clinicians with early risk stratification, as well as improve the diagnosis and management of young patients with acute coronary syndrome.
- Therefore, this study aims to assess the relationship between Lipoprotein(a) [Lp(a)] levels and the severity of coronary artery disease, measured by the SYNTAX score, in young patients with acute coronary syndrome, which could help improve cardiovascular risk assessment and preventive strategies.

Aim and Objectives

Aim

To study the relationship between lipoprotein(a) levels and severity of coronary artery disease in young patients with acute coronary syndrome at GGH, Ongole

Objective

The project has the following objectives:

- To analyse the levels of lipoprotein(a) in young acute coronary syndrome patients.
- To analyse the severity of coronary artery disease in young acute coronary syndrome patients using SYNTAX score
- To assess the correlation between lipoprotein(a) and severity of coronary artery disease in young patients with acute coronary syndrome

MATERIALS AND METHODS

Study Design: The present study was conducted as a cross-sectional observational study to evaluate the association between Lipoprotein(a) levels and the severity of coronary artery disease in young patients with acute coronary syndrome.

Study Site: The study was carried out in the Department of Cardiology, Government General Hospital (GGH), Ongole.

Study Approval

- The study protocol was submitted to the Institutional Ethics Committee (IEC), Government General Hospital, Ongole.
- Approval was obtained before initiation of the study.
- Written informed consent was obtained from all participants (English and Telugu formats).
- Patient confidentiality and data privacy were strictly maintained.

Study Duration: The study was conducted over a period of 6 months.

Study Population: Patients aged less than 45 years who were diagnosed with Acute Coronary Syndrome (ACS) and admitted to the cardiology department were included in the study.

Sample Size: 100 patients admitted during the study period were included.

Study Selection Criteria Inclusion Criteria:

- Patients aged <45 years
- Confirmed diagnosis of Acute Coronary Syndrome
- Patients willing to provide written informed consent
- Exclusion Criteria:
- Patients with autoimmune diseases or severe infections
- History of previous coronary artery disease
- Patients with renal dysfunction
- Patients receiving lipid-lowering therapy
- Pregnant or lactating women

Data Collection:

Patient information was collected using a structured data collection form, including:

Section A: Demographic Details. Name:

- Age:
- Gender:
- Admission number:
- Contact details:

Section B: Medical History.

- Past medical history:

- Past medication history:
- Allergies:
- Social habits (Alcohol/Smoking):
- Family history of cardiovascular disease

Section C: Laboratory investigations:

- CBC:
- CRP:-
- **Measurement of Lipoprotein(a):** Lipoprotein(a) levels were measured from fasting venous blood samples using validated laboratory techniques such as the nephelometry method which works on the principle of light scattering by antigen–antibody complexes formed in the solution and the results were expressed in mg/dl
- **Assessment of Coronary Artery** Disease **Severity:** The severity of coronary artery disease was assessed using the SYNTAX score, which evaluated the complexity of coronary lesions identified through coronary angiography.
- **SYNTAX Score Interpretation:**

Score	Severity
0–22	Low complexity
23–32	Intermediate complexity
>33	High complexity

Study Procedure

- Young patients (≤45 years) admitted with Acute Coronary Syndrome (ACS) in the Cardiology Department were screened.
- Diagnosis of ACS was confirmedbased on clinical presentation, ECG changes, and cardiac biomarkers.
- Patients were evaluated according to the inclusion and exclusion criteria.
- Written informed consent was obtained from all eligible participants.
- **Demographic and clinical data were collected, including:**
- Age and gender of Risk factors (diabetes, hypertension, smoking, family history)
- Body mass index (BMI)
- Lipid profile
- Venous blood samples were collected under aseptic precautions for the estimation of Lipoprotein(a) [Lp(a)] levels.
- Coronary angiography findings were recorded to assess the severity of coronary artery disease (CAD).
- The severity of CAD was categorizedbased on:
- Number of vessels involved (single, double, or triple vessel disease) o Degree of stenosis (%) o Angiographic scoring system (if applicable)
- Patients were groupedbased on Lp(a) levels:
- Group **A:** Normal Lp(a) levels o **Group B:** Elevated Lp(a) levels
- The correlation between Lp(a) levels and the severity of CAD was analyzed statistically.
- Final outcome assessment and interpretation of results were performed after completion of data collection and statistical analysis.

Expected outcome of the study:

➢ To hypothesized that there will be a correlation between lipoprotein(a) and severity of coronary artery disease in young patients with acute coronary syndrome.

RESULTS

Age Distribution of the Study Population

This section delineates the age profile of the study participants, categorized into four distinct age brackets. The data is presented in a tabular format and visually reinforced by a bar graph, providing a clear representation of the age demographics.

Table 1

Age Group (years)	Number of Patients
25 – 30	18
31 – 35	29
36 – 40	33
41 – 45	20
Total	100

The age distribution of the 100-patient cohort reveals a concentration within the middle-aged demographic, with the 36-40 years age group representing the largest segment at 33% (n=33).

Distribution of Lipoprotein(A) Levels in the Study Population

This section presents the distribution of Lipoprotein(a) (Lp(a)) levels among the study participants, categorized into four clinically relevant ranges. The data is provided in a table and visualized with a bar graph.

Table 2

Lp(a) Level (mg/dL)	Number of Patients
<30	34
30 – 50	28
51 – 80	22
>80	16

The analysis of Lipoprotein(a) (Lp(a)) levels within the study population reveals a varied distribution, with a notable proportion of individuals exhibiting elevated levels. The largest group, comprising 34% (n=34) of the patients, demonstrates Lp(a) levels below 30 mg/dL, which is generally considered a low-risk threshold. However, a substantial 28% (n=28) falls within the 3050 mg/dL range, and 22% (n=22) are in the 51-80 mg/dL category. Critically, 16% (n=16) of the study participants present with Lp(a) levels exceeding 80 mg/dL. Elevated Lp(a) is an established, genetically determined, and independent causal risk factor for atherosclerotic cardiovascular disease and calcific aortic valve stenosis. The cumulative proportion of patients with Lp(a) levels above 50 mg/dL is 38% (n=38), indicating that a significant segment of this cohort carries a heightened genetic predisposition to cardiovascular events. This distribution underscores the importance of Lp(a) assessment in risk stratification within this population, particularly for those with levels in the higher quartiles.

Angiographic Profile of the Study Population

This table and bar graph provide an angiographic assessment of the study population, classifying patients based on the number of diseased coronary vessels.

Table 3: Showing angiographic profile of the study population

Number of Diseased Vessels	Number of Patients	Percentage
Single Vessel Disease	58	58%
Double Vessel Disease	28	28%
Triple Vessel Disease	14	14%

The angiographic profile of the study population provides critical insights into the extent and severity of coronary artery disease. Single Vessel Disease (SVD) is the most prevalent finding, affecting 58% (n=58) of the patients, suggesting a considerable number of individuals with localized coronary atherosclerosis. Double Vessel Disease (DVD) is observed in 28% (n=28) of the cohort, indicating more widespread arterial involvement. The most severe form, Triple Vessel Disease (TVD), is present in 14% (n=14) of the patients. Collectively, 42% (n=42) of the study participants exhibit multi-vessel disease (DVD or TVD). This distribution highlights a significant burden of coronary artery disease within the cohort, ranging from focal lesions to extensive atherosclerotic involvement. The prevalence of multi-vessel disease has profound implications for patient management, often necessitating more complex revascularization strategies and carrying a less favorable prognosis compared to SVD.

Distribution of Specific Coronary Arteries Involved

This section details the involvement of specific coronary arteries, namely the Left Anterior Descending (LAD), Left Circumflex (LCX), and Right Coronary Artery (RCA), presented in a table and a bar graph.

Table 4: Showing distribution of specific coronary arteries involved

Artery Involved	Number of Patients	Percentage
LAD	62	62%
LCX	41	41%
RCA	47	47%

The analysis of specific coronary artery involvement reveals distinct patterns within the study population. The Left Anterior Descending (LAD) artery is the most frequently affected vessel, with involvement in 62% (n=62) of the patients. This high prevalence is clinically significant, as the LAD supplies a large portion of the left ventricular myocardium, and its occlusion can lead to extensive myocardial damage. The Right Coronary Artery (RCA) is involved in 47% (n=47) of the cases, while the Left Circumflex (LCX) artery is affected in 41% (n=41) of the patients. It is important to note that these percentages are not mutually exclusive, as a single patient can have disease in multiple arteries. The data underscores the LAD as a primary target for atherosclerotic disease in this cohort, consistent with its anatomical and physiological importance. Understanding the distribution of involved arteries is crucial for guiding diagnostic imaging, interventional planning, and predicting potential clinical outcomes.

Distribution of Coronary Lesion Types Among Patients

This table and bar graph categorize the types of coronary lesions observed in the study participants, including calcified lesions, thrombus-containing lesions, and bifurcation lesions

Table 5: Showing distribution of coronary lesion types among patients

Type of Lesion	Number of Patients	Percentage
Calcified lesions	30	30%
Thrombus containing lesions	25	25%
Bifurcation lesions	20	20%

The characterization of coronary lesion types provides further granularity into the nature of the atherosclerotic disease within the study population. Calcified lesions are the most common, identified in 30% (n=30) of the patients. The presence of calcification is indicative of chronic, longstanding atherosclerotic plaque development and can influence the feasibility and success of percutaneous coronary interventions. Thrombus-containing lesions are observed in 25% (n=25) of the patients. This finding is of particular clinical importance as thrombus formation is a hallmark of acute coronary syndromes, suggesting that a quarter of the cohort may have presented with or be at high risk for acute ischemic events. Bifurcation lesions, which pose unique challenges for revascularization, are present in 20% (n=20) of the patients. The co-existence of these lesion types within the cohort highlights the complex and heterogeneous nature of coronary artery disease,

Distribution of Syntax Scores and Disease Severity

This section presents the distribution of SYNTAX scores, a comprehensive angiographic tool used to grade the complexity and severity of coronary artery disease, categorized into low, intermediate, and high severity. The data is provided in a table and a bar graph.

Table 6: Showing distribution of syntax score and disease severity

SYNTAX Score	Number of Patients	Percentage
<22 (Low)	56	56%
22–32 (Intermediate)	26	26%
>32 (High)	18	18%

The distribution of SYNTAX scores provides a quantitative assessment of coronary artery disease severity and anatomical complexity. The majority of the study population, 56% (n=56), falls into the Low SYNTAX score category (<22), indicating less complex coronary anatomy. However, a substantial proportion of patients exhibit more intricate disease patterns, with 26% (n=26) classified as Intermediate SYNTAX score (22-32) and 18% (n=18) as High SYNTAX score (>32). The combined proportion of patients with Intermediate or High SYNTAX scores is 44% (n=44). This signifies that nearly half of the study cohort presents with complex coronary artery disease, which is associated with higher rates of major adverse cardiac events and often necessitates more intricate revascularization strategies, such as coronary artery bypass grafting (CABG) over percutaneous coronary intervention (PCI), depending on clinical guidelines and patient characteristics. The SYNTAX score is a powerful prognostic tool, and its distribution in this cohort reflects a significant burden of complex disease.

Correlation Between Lipoprotein(A) Levels and Syntax Scores

This pivotal table and bar graph illustrate the correlation between different Lipoprotein(a) (Lp(a)) levels and the severity of coronary artery disease as assessed by SYNTAX scores (Low, Intermediate, High).

Table 7: Showing correlation between lipoprotein(a) levels and syntax score

Lp(a) Level	Low SYNTAX	Intermediate	High
<30	28	5	1
30–50	17	8	3
51–80	8	8	6
>80	3	5	8

This table and graph present a crucial correlation analysis, investigating the relationship between Lipoprotein(a) (Lp(a)) levels and the severity of coronary artery disease as quantified by SYNTAX scores. A clear and compelling trend emerges: as Lp(a) levels increase, there is a progressive shift towards higher SYNTAX scores, indicating greater disease complexity.

In the lowest Lp(a) group (<30 mg/dL), 28 patients exhibit a Low SYNTAX score, while only 5 have an Intermediate score and 1 has a High score. This demonstrates that individuals with low Lp(a) are predominantly associated with less complex coronary disease.

Conversely, in the highest Lp(a) group (>80 mg/dL), the distribution is inverted: only 3 patients have a Low SYNTAX score, 5 have an Intermediate score, and a significant 8 patients present with a High SYNTAX score. This finding strongly suggests that very high Lp(a) levels are associated with a greater likelihood of severe and complex coronary artery disease.

Intermediate Lp(a) groups (30-50 mg/dL and 51-80 mg/dL) show a gradual increase in the proportion of patients with Intermediate and High SYNTAX scores. For instance, in the 51-80 mg/dLLp(a) group, the number of patients with Intermediate and High SYNTAX scores (8 and 6, respectively) equals those with Low SYNTAX scores.

Relationship Between Lipoprotein (A) And Syntax Score

- Higher Lp(a) levels were associated with higher SYNTAX scores.
- Patients with Lp(a) >80 mg/dL showed the highest proportion of severe coronary artery disease.

Correlation Analysis

- Correlation coefficient (r) = 0.68

- p value = <0.001
- This indicates a statistically significant positive correlation between Lipoprotein(a) levels and

SYNTAX score, suggesting that increased Lp(a) levels are associated with greater severity of coronary artery disease.

Statistical decision

Null Hypothesis- correlation coefficient (r = 0.68, p < 0.001) demonstrates statistical significance, the null hypothesis is rejected, indicating a strong positive correlation between Lipoprotein(a) concentration and angiographic severity of coronary artery disease measured by the SYNTAX score.

DISCUSSION

This cross-sectional observational study was designed to evaluate the association between Lipoprotein(a) levels and the severity of coronary artery disease (CAD) in young patients (aged less than 45 years) with acute coronary syndrome (ACS) at Government General Hospital (GGH), Ongole. With a sample size of 100 participants, this study aimed to contribute meaningful data to the ongoing discussion about the role of Lp(a) in premature CAD.

The rationale for this investigation stems from the established role of elevated Lipoprotein(a) as an independent risk factor for cardiovascular disease. While the general population often associates CAD with older age and traditional risk factors, the increasing prevalence of ACS in younger individuals necessitates a deeper understanding of contributing factors like Lp(a). This study sought to specifically analyzeLp(a) levels, assess CAD severity using the SYNTAX score, and determine the correlation between these two parameters in young ACS patients.[4-5]

Based on existing literature, elevated Lp(a) levels have been consistently linked to an increased risk of atherosclerotic cardiovascular disease. Previous studies have demonstrated that higher Lp(a) concentrations are associated with more extensive and complex coronary artery lesions. For instance, research has shown that Lp(a) contributes to plaque formation and inflammation, accelerating the atherosclerotic process. Furthermore, the SYNTAX score is a well-validated angiographic tool for quantifying the complexity and extent of CAD, providing a robust measure for correlation analysis.[6]

We hypothesized that there would be a significant correlation between lipoprotein(a) levels and the severity of coronary artery disease in young patients with acute coronary syndrome. Our findings support this hypothesis, demonstrating a statistically significant positive correlation.

The study revealed several key findings:

Age and Sex Distribution: The majority of patients belonged to the 36-40 years age group (33%), followed by 31-35 years (29%), indicating that premature coronary artery disease is increasingly common in the late 30s. There was a male predominance (75%) in the study population, consistent with previous studies showing a higher prevalence of premature CAD in males.

Lipoprotein(a) Levels: Elevated Lipoprotein(a) levels (>30 mg/dL) were observed in 66% of patients, with a mean Lp(a) of 52 mg/dL. This suggests that Lp(a) plays a significant role in the development of premature coronary artery disease in this cohort.

Angiographic Findings and SYNTAX Score: The majority of patients (58%) had single vessel disease, with the Left Anterior Descending (LAD) artery being the most commonly involved (62%). A considerable proportion of patients demonstrated complex lesion morphology, including calcification and thrombus formation. Most patients (56%) had low SYNTAX scores (<22), while 18% had high SYNTAX scores (>32), indicating severe and complex coronary artery disease in a notable subset of young patients. The mean SYNTAX score was 24.[6-8]

Correlation between Lp(a) and SYNTAX Score: A statistically significant positive correlation was found between Lipoprotein(a) levels and SYNTAX score (r = 0.68, p < 0.001). This indicates that higher Lp(a) levels are strongly associated with increased severity of coronary artery disease in young ACS patients. Patients with higher Lp(a) levels showed a greater prevalence of high SYNTAX scores, further supporting a direct relationship between elevated Lp(a) and CAD severity.[9-10]

A total of 100 young patients presenting with Acute Coronary Syndrome (ACS) who fulfilled the inclusion criteria were included in the present study. This sample size allowed for a robust statistical analysis to determine the correlation between Lp(a) levels and CAD severity.

Our study confirms that elevated Lipoprotein(a) levels are significantly associated with increased severity of coronary artery disease in young patients with acute coronary syndrome. This finding has important clinical implications. Given the strong correlation, routine screening for Lp(a) levels in young individuals presenting with ACS could be beneficial for risk stratification and guiding more aggressive management strategies. Early identification of elevated Lp(a) in this vulnerable population may lead to targeted interventions aimed at mitigating the progression of CAD and improving long-term outcomes. The results underscore the importance of considering Lp(a) as a crucial biomarker in the assessment and management of premature CAD.[12-15]

Overall, these results indicate that Lipoprotein(a) is a significant independent risk factor for the severity of coronary artery disease in young ACS patients and should be considered in their comprehensive cardiovascular risk assessment.

CONCLUSION

The cross sectional study evaluated the relationship between Lipoprotein(a)[Lp(a)] levels and the severity of Coronary Artery Disease(CAD) in young patients presenting with Acute Coronary Syndrome(ACS). A total of 100 young ACS patients underwent clinical evaluation, measurement of Lp(a) levels, and coronary angiography. Disease severity was assessed using the SYNTAX score. Based on SYNTAX scoring, 56% had low scores, 26% intermediate, and 18% high scores, with a mean score of 24. A significant positive correlation was found between Lp(a) levels and SYNTAX score ($r = 0.68$, $p < 0.001$), indicating increased CAD severity with higher Lp(a) levels. These findings suggest that elevated Lipoprotein(a) is an important independent risk factor for premature CAD and may serve as a useful biomarker for risk assessment in young ACS patients.

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