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Original research article

Study of association of serum vitamin d, serum homocysteine and lipid profile in acute coronory syndrome patients

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Abstract

The present study investigates the association of serum vitamin D, serum homocysteine, and lipid profile in patients with acute coronary syndrome (ACS). The aim was to analyze the levels of serum vitamin D, homocysteine, and lipid profile components in ACS patients and to examine the correlations with disease progression. This prospective observational study was conducted at MGM Medical College, Aurangabad, India, from September 2022 to June 2024. A total of 96 diagnosed ACS patients were enrolled, including those with ST-segment elevation myocardial infarction (STEMI), non-ST-segment elevation myocardial infarction (NSTEMI), and unstable angina. Routine lab tests assessed total cholesterol, LDL, HDL, triglycerides, vitamin D, and homocysteine. Non-HDL cholesterol was calculated using the standard equation. Statistical analysis was performed using SPSS software with a p-value of <0.05 considered significant. Results showed that 46.87% of patients were vitamin D deficient, and 59.38% had intermediate serum homocysteine levels. Most patients had optimal total cholesterol and non-HDL cholesterol, but 75% had low HDL levels and 25% had elevated triglycerides. Smoking was associated with significantly lower HDL levels (p=0.006), while alcohol consumption was linked to higher serum homocysteine levels (p=0.009). In conclusion, vitamin D deficiency and elevated homocysteine levels are prevalent among ACS patients, which may contribute to ACS pathogenesis. The study underscores the potential benefits of addressing vitamin D deficiency and managing homocysteine levels in ACS patients.

Keywords: Acute coronary syndrome, serum vitamin D, serum homocysteine, lipid profile, non-HDL cholesterol, triglycerides, HDL cholesterol, smoking, alcohol

Introduction

Acute Coronary Syndrome (ACS) encompasses a spectrum of conditions arising from the sudden reduction of blood flow to the heart muscle due to the abrupt blockage of a coronary artery. ACS is a manifestation of CHD (coronary heart disease) and usually a result of plaque disruption in coronary arteries. ACS is a leading cause of morbidity and mortality in developed and developing countries [1]. Recent research suggests a correlation between vitamin D deficiency and various cardiovascular issues, such as elevated blood pressure, increased insulin resistance, heart failure, and fatal strokes [2]. Elevated plasma Hcylevels independently contribute to the risk of peripheral vascular, cerebrovascular, and coronary heart diseases. Endothelial cell proliferation is slowed by Hcy, as demonstrated by numerous *in vitro* studies revealing that, the introduction of Hcyinto cell cultures results in damage to endothelial cells [3]. Thus, the aim of this study was to determine the association of serum vitamin D, serum Hcy and lipid profile in acute coronory syndrome patients.

Aim and Objectives

Aim

To Study levels of vitamin D, serum homocysteine and lipid profile in acute coronary syndrome patients.

Objectives

1. To analyse levels of serum vitamin D in patients with acute coronary syndrome.
2. To analyse levels of serum homocysteine in patients with acute coronary syndrome.
3. To study association of non-HDL cholesterol levels with patients of acute coronary syndrome.

Material and Methodology

Study Design: This was a prospective observational study. The purpose of the study was to investigate the association of serum vitamin D, serum homocysteine, and lipid profile in patients with acute coronary

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syndrome.

Study Setting: This study was carried out at MGM Medical College & Hospital, Aurangabad.

Study Population: Diagnosed cases of acute coronary syndrome fulfilling inclusion criteria.

Study Duration: 15 September 2022 to 10 June 2024

Sample Size: (n) = 96 cases

Inclusion Criteria

Patients of ACS of either sex with age above 18 years old

1. ST segment elevation myocardial infraction.
2. Non-ST segment elevation myocardial infraction.
3. Unstable angina.

Exclusion Criteria

1. Patients with structural heart diseases (Rheumatic heart disease, congenital heart disease, pericardial disorders).
2. Patients on vitamin D supplements.
3. Pregnant females.

Detailed Research Plan

The initial diagnosis of ACS was determined based on ECG findings, elevated levels of cardiac biomarkers (Trop-T/CK-MB/Trop-I), and 2D-ECHO. Routine laboratory diagnosis like Fasting venous blood samples were collected in serum vacutainers. Further we assessed the, lipid profile (total cholesterol, LDL cholesterol, triglyceride, HDL cholesterol) by "Vitross 5600" machine by dry slide technique, serum vitamin D by "Vitross 5600" machine andserum homocysteine by "Vitross 5600 by turbidometry method. Non-HDL cholesterol levels were calculated by this equation: (Non-HDL cholesterol = Total cholesterol-HDL cholesterol).

Smokes are taken as those patients who are smoking every day for at least one year [4]. Alcoholics are taken as those patients who consume alcohol at least four times/week for at least one year.

Statistical Analysis: Statistical analysis was done using SPSS software and a test of association was done using binary logistic regression. The entire statistical test at p value less than 0.5 was considered significant.

Results

The study examined the association between serum vitamin D, serum homocysteine, and lipid profile in patients with acute coronary syndrome (ACS). The demographic characteristics of the study population revealed an average age of 61.91 years and an average BMI of 25.43 with a SD of 2.76. The gender distribution showed 43 female patients (44.79%) and 53 male patients (55.21%). Out of 96 patients of ACS; majority of the patients 58.33% (56) belonged to age group between 50-70 years. 18.75% (18) patients were <50 years old while 22.91% (22) were >70 years old. Out of total 96 cases; 35.41% (34) were STEMI, 33.33% (32) were NSTEMI while 31.25% (30) patients were diagnosed as unstable angina.

Table 1: Distribution according to addictions in ACS patients

Addictions	Yes	No
Smoker	39 (40.63%)	57 (59.38%)
Alcoholic	28 (29.17%)	68 (70.83%)
Smoker +Alcoholic	24 (25.00%)	72 (75.00%)
Total	96	

39 patients reported smoking (40.63%) while 57 did not, and 28 patients reported alcohol consumption (29.17%), while 68 did not. 24 (75%) out of total 96 ACS patients reported both smoking and alcohol consumption.

ISSN:0975 -3583,0976-2833 VOL 16, ISSUE 01, 2025

Table 2: Distribution according to comorbidities in ACS patients

Comorbidities	Yes	No
Diabetes mellitus	72 (75.00%)	24 (25.00%)
Hypertension	56 (58.33%)	40 (41.67%)
Diabetes + Hypertension	40 (41.67%)	56 (58.33%)
Total	96	

72 patients (75.00%) were diabetic while 24 (25.00%) were non- diabetic and 56 patients (58.33%) were hypertensive, while 40 (41.67%) were non-hypertensive. Out of total 96 patients of ACS, 40 (41.67%) had both diabetes mellitus and hypertension.

Table 3: Vitamin D levels in patients with ACS

Serum Vitamin D (ng/dl)	No of cases	Percentage
Sufficiency (>30)	20	20.83%
Insufficiency (20-30)	31	32.29%
Deficiency (<20)	45	46.87%

Among the ACS patients, 20.83% had sufficient levels of vitamin D (>30ng/dl) while32.29% patients showed vitamin D insufficiency (20–30 ng/dl) and 46.87 were vitamin D deficient (<20ng/dl). This distribution highlighted a significant prevalence of vitamin D deficiency among ACS patients.

Table 4: Serum Hcy. Levels in patients with ACS

Homocysteine (Umol/L)	No of cases	Percentage
Optimal (4.7-12.5)	26	27.08%
Intermediate (12.6-30)	57	59.38%
Severe high (>30)	13	13.54%

Among the ACS patients, 27.08% exhibited optimal homocysteine levels (4.7-12.5 µmol/L), while 59.38% fell into the intermediate range (12.6-30 µmol/L), and 13.54% had severe high levels (>30 µmol/L).

Table 5: Total cholesterol levels in patients with ACS

Total cholesterol (mg/dl)	No of cases	Percentage
Optimal (<200)	80	83.33%
Intermediate (200-239)	10	10.42%
Severe high (>239)	6	6.25%

The study found that most acute coronary syndrome (ACS) patients had optimal total cholesterol levels (<200 mg/dl), with 83.33% falling in this range. A smaller percentage were in the intermediate (200-239 mg/dl) and severe high (>239 mg/dl) categories.

Table 6: HDL cholesterol levels in patients with ACS

HDL cholesterol (mg/dl)	No of cases	Percentage
Optimal (>50)	5	5.21%
Intermediate (40-50)	19	19.79%
Low (<40)	72	75.00%

The study showed a significant association between low HDL cholesterol levels and acute coronary syndrome (ACS). Most ACS patients (75.00%) had low HDL levels (<40 mg/dl), indicating low HDL as a potential risk factor for ACS.

Table 7: Non-HDL cholesterol levels in patients with ACS

Non-HDL cholesterol (mg/dl)	No of cases	Percentage
Optimal (<150)	70	72.92%
Intermediate (150-159)	10	10.42%
Severe high (>159)	16	16.67%

The most of the acute coronary syndrome (ACS) patients had optimal non-HDL cholesterol levels (<150 mg/dl), with 72.92% falling in this range. A smaller percentage were in the intermediate (150-159 mg/dl) and severe high (>159 mg/dl) categories.

ISSN:0975 -3583,0976-2833 VOL 16, ISSUE 01, 2025

Table 8: Triglyceride levels in patients with ACS

Non-HDL cholesterol (mg/dl)	No of cases	Percentage
Optimal (<150)	49	51.04%
Intermediate (150-199)	24	25.00%
Severe high (>200)	23	23.96%

The study found that a significant portion of acute coronary syndrome (ACS) patients had elevated triglyceride levels: 25.00% were in the intermediate range (150-199 mg/dl), and 23.96% had severe high levels (>200 mg/dl).

Table 9: Distribution of Serum Homocysteine levels among smokers and non-smokers

Smoking	Serum Homocysteine (Umol/L) <15		Serum Homocysteine (Umol/L) ≥15		Chi-square	P-value
	No of cases	Percentage	No of cases	Percentage		
Yes (Smoker)	12	30.00%	27	48.21%	3.21	0.073
No (Non-smoker)	28	70.00%	29	51.79%		
Total	40	100.00%	56	100.00%		

30.00% of smokers are having serum homocysteine levels below 15 μmol/L and 48.21% having levels ≥15 μmol/L. Among non-smokers, 70.00% had levels below 15 μmol/L, and 51.79% had levels ≥15 μmol/L. The association between smoking and serum homocysteine levels was not statistically significant. (p>0.05)

Table 10: Distribution of serum Homocysteine levels in alcoholics and non-alcoholics

Alcohol consumption	Serum Homocysteine (Umol/L) <15		Serum Homocysteine (Umol/L) ≥15		Chi-square	P-value
	No of cases	Percentage	No of cases	Percentage		
Yes (alcoholic)	6	15.00%	22	39.29%	6.66	0.009
No (Non-alcoholic)	34	85.00%	34	60.71%		
Total	40	100.00%	56	100.00%		

In the study, alcoholics had a higher percentage of serum homocysteine levels ≥15 μmol/L (39.29%) compared to non-alcoholics (60.71%). A p value <0.005 showed a significant association between alcohol consumption and serum homocysteine levels.

Table 11: Lipid profile in smokers and non-smokers

Smoking	Total cholesterol	HDL	Non-HDL	LDL	Triglyceride
Yes (n=39) (Smoker) Mean ± SD	157.87 ±51.132	31.08 ± 6.76	126.90 ±49.52	43.04±89.06	194.41 ±156.02
No (n=57) (Non-Smoker) Mean ± SD	174.08 ± 152.34	36.19 ± 10.05	119.78 ±38.4	34.96 ±88.14	158.54±70.29
P-value	0.52	0.006	0.43	0.99	0.13

The study indicated that smoking was associated with significantly lower HDL levels (31.08 ± 6.76 vs. 36.19 ± 10.05 mg/dL, p = 0.006) but showed no significant differences in total cholesterol, non-HDL, LDL, or triglycerides between smokers and non-smokers among ACS patients.

Table 12: Lipid profile in Alcoholics and Non-alcoholics

Alcohol	Total cholesterol	HDL	Non-HDL	LDL	Triglyceride
Yes (n=28) (Alcoholic) Mean ±SD	170.32± 50.77	33.11 ± 9.79	137.32 ± 48.99	99.28 ± 46.50	199.178 ± 174.38
No (n=68) (Non-Alcoholic) Mean ±SD	166.33 ± 141.61	34.52 ± 8.95	116.64 ± 39.34	84.09 ± 33.66	162.30 ± 75.67
P-value	0.87	0.46	0.02	0.06	0.16

Alcohol consumption among ACS patients was associated with slightly higher mean levels of total cholesterol, HDL, non-HDL, LDL, and triglycerides compared to non-alcoholic patients. Found no significant differences in total cholesterol, HDL, LDL, and triglycerides between alcoholic and non-alcoholic ACS patients, except for non-HDL levels, which were higher in alcoholic patients (p = 0.02).

ISSN:0975 -3583,0976-2833 VOL 16, ISSUE 01, 2025

Discussion

ACS encompasses a spectrum of conditions, including unstable angina and myocardial infarction, with a common underlying pathology of coronary artery plaque rupture or erosion leading to thrombus formation. The role of various biomarkers in the pathogenesis and progression of ACS has been widely studied, with a particular interest in serum vitamin D, serum homocysteine, and lipid profile due to their potential impact on cardiovascular health.

This study aimed to investigate the association between serum vitamin D, serum homocysteine, and lipid profile in ACS patients, shedding light on their potential roles as biomarkers or therapeutic targets in this population.

This prospective study conducted at MGM Medical College & Hospital, Aurangabad, aimed to investigate the association between serum vitamin D, serum homocysteine, and lipid profile in patients with acute coronary syndrome (ACS). The study included 96 diagnosed cases of ACS admitted to the hospital over a two-year period from 15 September 2022 to 10 June 2024. Out of total 96 cases; 35.41% (34) were STEMI, 33.33% (32) were NSTEMI while 31.25% (30) patients were diagnosed as unstable angina. The study population had an average age of 61.91 years and an average BMI of 25.43, with a gender distribution of 44.79% female and 55.21% male. Among the patients, 40.63% reported smoking,29.17% reported alcohol consumption and 25.00% reported both addictions. Out of total 96 patients, 75.00% were diabetic and 58.33% were hypertensive while 41.67% had both diabetes and hypertension. In terms of vitamin D, our study found a significant prevalence of insufficiency (32.29%) and deficiency (46.87%) among ACS patients.

In our study Serum homocysteine levels were optimal in 27.08% of ACS patients, while 59.38% had intermediate levels and 13.54% had severe high levels. Most ACS patients had optimal total cholesterol levels (<200 mg/dl) and non-HDL cholesterol levels (<150 mg/dl). However, a significant portion had decreased HDL levels (<40 mg/dl) and elevated triglyceride levels (25.00% in the intermediate range and 23.96% with severe high levels). The analysis revealed that alcohol consumption was significantly associated with higher serum homocysteine levels ($p = 0.009$), while smoking showed no significant association. Alcoholics had a higher percentage of serum homocysteine levels ≥15 µmol/L compared to non-alcoholics (39.29% vs. 60.71%). Regarding lipid profiles, smoking was associated with significantly lower HDL levels ($p = 0.006$) but showed no significant differences in total cholesterol, non-HDL, LDL, or triglycerides. Alcohol consumption was associated with slightly higher mean levels of total cholesterol, HDL, non-HDL, LDL, and triglycerides compared to non-alcoholic patients, with a significant difference only in non-HDL levels ($p = 0.02$).

The association between serum vitamin D levels and ACS was examined in the study population. Serum vitamin D levels were categorized into three groups: sufficient (>30ng/dL), insufficient (20-30 ng/dl) and deficient (< 20ng/dL). Among the cases studied, 20.83% had sufficient serum vitamin D levels, 32.29% had vitamin D insufficiency while 46.87% were vitamin D deficient. These findings indicate a high prevalence of serum vitamin D deficiency in ACS patients, highlighting a potential association between vitamin D status and ACS. Further research is needed to elucidate the role of vitamin D in the pathogenesis and progression of ACS.50 controls and 73 consecutive adult patients with ACS were included in study done by Ismail *et al*. in 2021 [5]. They discovered a strong correlation between acute coronary syndrome (ACS) and vitamin D and all of its metabolites. In particular, low levels of 1,25(OH) D and 25(OH) D were associated with an increased risk of ACS, although vitamin D_2 and D_3 did not exhibit this predictive value. According to the report, significant randomised controlled trials are required to validate the possible advantages of vitamin D supplementation in patients with ACS. Anghan *et al*. [6] (2019) included a total of 310 patients. They reported that a majority (82.9%) of the enrolled patients with acute coronary syndrome (ACS) were deficient in vitamin D, highlighting a prevalent association between ACS and vitamin D deficiency. The study also observed that patients with cardiovascular risk factors such as diabetes and dyslipidemia were more likely to be deficient in vitamin D. Serum homocysteine levels were categorized into three groups: optimal (4.7-12.5 µmol/L), intermediate (12.6-30 µmol/L), and severe high (>30 µmol/L). The analysis revealed that 27.08% of cases had optimal serum homocysteine levels, while the majority, accounting for 59.38% of cases, fell into the intermediate range. Additionally, 13.54% of cases were classified as having severe high serum homocysteine levels. These findings suggest a significant prevalence of elevated serum homocysteine levels, particularly in the intermediate range, among individuals with ACS. Further research is warranted to explore the implications of these findings and the potential role of homocysteine in the pathogenesis of ACS. The results of our study were consistent with those of a study by Begum *et al*. [7] (2022), which included 52 patients, among whom 26 were aged >40 and 26 were aged ≤40. They concluded that serum homocysteine levels were significantly higher in young patients with coronary artery disease compared to adult patients. Therefore, elevated serum homocysteine levels may serve as a valuable marker for detecting and evaluating coronary artery disease in young individuals. The findings of Jeong *et al*. [8] (2018) from their study on 2,682,045 young adults (aged 20–39 years) stated that elevated cholesterol levels were significantly associated with a higher risk of cardiovascular disease (CVD) in young adults. Conversely, young adults with lower cholesterol levels exhibited a reduced risk for CVD.

ISSN:0975 -3583,0976-2833 VOL 16, ISSUE 01, 2025

The comparison of lipid profiles between smokers and non-smokers showed that smokers had significantly lower levels of HDL cholesterol compared to non-smokers. No significant differences were observed in total cholesterol, non-HDL cholesterol, LDL cholesterol, and triglyceride levels between the two groups. These findings emphasize the detrimental effect of smoking on HDL cholesterol, a known protective factor against cardiovascular disease.

Conclusion

Based on the findings of the present study, it was concluded that, Most of the ACS patients were vitamin D deficient, indicating a potential role of vitamin D deficiency in the development of ACS.

Also, the majority of ACS patients had intermediate levels of serum homocysteine, suggesting a possible association between elevated homocysteine levels and ACS.

Although significant proportion of ACS patients had elevated triglyceride and decreased HDL cholesterol levels, majority of them had optimal levels of non-HDL cholesterol levels since total cholesterol levels were also within optimal range among most of the patients.

Alcoholics exhibited a significantly higher percentage of serum homocysteine levels ≥15 μmol/L compared to non-alcoholics, indicating a significant association between alcohol consumption and serum homocysteine levels.

While serum homocysteine levels ≥15 μmol/L were observed in higher percentage of patients who smoke, the association was not statistically significant.

Smoking was associated with significantly lower HDL levels but showed no significant differences in total cholesterol, non-HDL, LDL, or triglycerides between smokers and non-smokers.

Alcohol consumption was not significantly associated with total cholesterol, HDL, LDL, or triglycerides, except for non-HDL levels, which were higher in alcoholic patients.

These findings underscore the importance of lifestyle modifications and targeted interventions in the management of `ACS; Further large population-based studies will be required to confirm potential role of vitamin D supplementation and serum homocysteine lowering therapies in treatment of ACS.

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