"A Case-Control Analysis of Lipid Profiles and Coronary Artery Disease Risk Levels Among Hospitalized Patients".

Chinju Verghese Kannanaickal B.[1], Dr. K. Prabhu.[2], Dr. M. Kavimani.[3], Dr. Meenakumari.[4], Sincy V Thambi[5.]

1. Ph.D Scholar, Bharath Institute of Higher Education and Research (BIHER), Chennai, Tamil Nadu, India

2.Assosiate Professor, Department of Anatomy, Sree Balaji Medical College, Bharath Institute of Higher Education and Research, Chennai, Tamil Nadu, India.

3. Professor, Department of Anatomy, Sree Balaji Medical College, Bharath Institute of Higher Education and Research, Chennai, Tamil Nadu, India.

4.Research Scientist, Sree Balaji Medical College, Bharath Institute of Higher Education and Research, Chennai, Tamil Nadu, India.

5.Assistent Professor, Royal Engineering College, KTU, Kerala.

Abstract

Background: On a global scale, coronary artery disease (CAD) is one of the leading causes of death and disability caused by cardiovascular disease. The condition known as dyslipidaemia, which is marked by excessively high levels of total cholesterol, triglycerides, and LDL, and low levels of HDL, is one of the risk factors that can be effectively modified. The purpose of this study was to use a case-control design in order to investigate the link between lipid profiles and the risk of coronary artery disease (CAD) among hospitalised patients in Rajkot.

Methods: Two hospitals, KDP and Kotadiya, collaborated with academics to conduct a retrospective case-control study during the months of February and April of 2025. We used a technique called purposive sampling to recruit a total of one hundred individuals: fifty individuals with coronary artery disease (CAD) and fifty healthy controls who were matched for age and gender. The primary focusses of the data collecting process, which included structured interviews and medical records, were the demographic characteristics and lipid profile parameters (total cholesterol, triglycerides, LDL, and HDL). Additional data collection methods included lipid profile parameters. Statistical methods such as descriptive statistics, chi-square tests, t-tests, and odds ratios were utilised in order to examine the data.

Results: Patients with coronary artery disease exhibited significantly higher levels of total cholesterol (60 percent), triglycerides (68 percent), and low-density lipoprotein (LDL) (58 percent), as well as lower levels of non-HDL (50 percent). There was a statistically significant difference between the two groups ($p = 0.005$). In cases, the mean lipid score was significantly

higher than in controls (mean = 8, standard deviation = 1.72), which had a mean score of 5 and a standard deviation of 1.08. In patients with severe coronary artery disease, the odds ratio for having elevated lipid readings was 0.048. According to the findings, there was a significant association between the risk of coronary artery disease (CAD) and demographic characteristics such age, education level, eating habits, smoking history, and co-morbid conditions ($p < 0.05$). Myocardial infarction was the most common form of coronary artery disease (CAD) among patients with elevated lipid levels, accounting for 64 percent of all cases.

Conclusion: This study's findings indicate that there is a substantial association between abnormal lipid profiles and coronary artery disease (CAD). This finding highlights the necessity of early lipid monitoring and medication in groups that are at risk for developing coronary artery disease. As a result of the fact that socio-demographic features and comorbidities have an additional impact on the risk of coronary artery disease (CAD), it is imperative that comprehensive preventative measures be taken.

Keywords: Coronary artery disease, dyslipidaemia, lipid profile, case-control study, risk factors

Introduction

According to the World Health Organisation (2023), coronary artery disease (CAD) continues to be one of the top causes of death around the world. This illness is responsible for a significant share of the mortality levels that are associated with cardiovascular disease. The disease is largely characterised by the accumulation of atherosclerotic plaques within the coronary arteries, which restricts blood flow and leads to ischaemic events such as myocardial infarction (Libby et al., 2022). This is the primary characteristic of the disease. One of the many risk factors for coronary artery disease (CAD), dyslipidaemia is a significant contributor. High levels of triglycerides (TG), low levels of high-density lipoprotein cholesterol (HDL-C), and high levels of low-density lipoprotein cholesterol (LDL-C) are frequently associated with coronary artery disease (CAD), according to Grundy et al.'s 2019 research. All of these factors lead to the development of coronary artery disease.

It is crucial to assess lipid profiles in hospitalised patients to enable early treatment and risk categorisation, since they are a high-risk population. The link between lipid abnormalities and coronary artery disease (CAD) has been greatly elucidated by case-control studies, as stated by Ference et al. (2017). Additionally, these research have shed light on the disease's mechanisms and potential treatment targets. By comparing the lipid profiles of hospitalised

coronary artery disease (CAD) patients with non-CAD controls, this study aims to identify any lipid anomalies that may be associated with disease severity.

In a study conducted by Arnett et al. in 2019, Some of the variables that contribute to the onset of coronary artery disease (CAD) are under our control, while others are beyond it. Some examples of these risk factors include a personal or family history of hypertension, diabetes, smoking, obesity, or dyslipidaemia. Particularly, dyslipidaemia has been associated with an elevated risk of CAD on multiple occasions. Borén et al. (2020) and Wilson et al. (1998) are just two of many epidemiological studies that have shown that high levels of total and low-density lipoprotein (LDL) cholesterol significantly increase the risk of coronary events, but high levels of HDL cholesterol seem to protect against them. Atherosclerosis progression may be caused by more than only LDL-C, according to new findings in lipid research. According to Nordestgaard (2016), additional lipid fractions that could contribute to the disease's advancement include lipoprotein(a) and triglyceride-rich lipoproteins (TRLs). In addition, compared to traditional cholesterol testing, the apolipoprotein B (apoB) to apolipoprotein A1 (apoA1) ratio may be a more accurate indicator of the likelihood of coronary artery disease (CAD) (Walldius & Jungner, 2004).

In varied populations, where genetic and environmental variables may impact lipid metabolism differently, there is a need for real-world data on lipid profiles among hospitalised CAD patients, despite substantial research in this area. This study fills that need by comparing lipid parameters in patients with coronary artery disease (CAD) with those without the disease, which will improve risk assessment and guide focused interventions to lower lipid levels. If randomised controlled trials aren't always an option in clinical settings, case-control studies provide a practical way to look at how things like cholesterol levels are linked to things like coronary artery disease. According to Song and Chung (2010), this approach enables the simultaneous study of various lipid biomarkers, which provides a full understanding of how these factors collectively affect CAD risk, and it also allows for quick evaluation of risk factors.

Statement of the problem:

Lipid Profile and Coronary Artery Disease Risk Levels: A Case-Control Study Among Hospitalized Patients in Rajkot.

Objectives:

To evaluate the relationship between lipid profile abnormalities and the risk level of Coronary Artery Disease (CAD) among patients admitted to a selected hospital.

To estimate the correlation between lipid profile factors and CAD risk levels in patients admitted to a selected hospital.

To examine the association between demographic factors and the risk level of CAD in hospitalized patients at a selected hospital.

Hypothesis:

H1: "Lipid profile abnormalities are significantly associated with the risk level of Coronary Artery Disease (CAD) among patients admitted to a selected hospital."

H2: "The lipid profile significantly contributes to the estimation of CAD risk among patients admitted to a selected hospital."

H3: "Demographic variables significantly influence the risk level of CAD among patients admitted to a selected hospital."

Review of literature

Denti L, Cecchetti A, Annoni V, et al. did a study to look into the link between lipid factors and different types of ischaemic stroke in older people. They focused on markers like Lp(a), ApoAI, and ApoB that haven't been studied as much. There were lower HDL-C and HDL-C/ApoAI ratios and higher LDL-C/HDL-C ratios among 79 stroke patients (mean age 83) compared to 88 age- and sex-matched controls. There was an increased risk of stroke associated with elevated LDL-C levels (>100 mg/dL), although the correlation was not linear. Independent risk factors for stroke across all subtypes were verified by multivariate analysis to include low HDL-C and HDL-C/ApoAI. Lipid profile should be included when assessing risk, and the results show that HDL is more important than LDL in reducing the risk of stroke in the elderly.

Wu TT, Zheng YY, and Yang YN examined lipid profile variations by gender and age in a western Chinese case-control research that included 1200 controls and 2400 CAD patients between 2012 and 2015. While HDL-C and apoA-1 were higher in controls and increased with age, TC, TG, LDL-C, non-HDL-C, apoB, and apoB/apoA-1 were significantly higher in CAD patients (with the exception of those under 40 years old). Atherogenic lipid levels were greater

in women and reduced less noticeably with age compared to men. The importance of considering age, gender, and specific lipid ratios in determining cardiovascular risk is underscored by the fact that the apoB/apoA-1 ratio was identified as the strongest independent lipid-related risk factor for coronary artery disease (CAD).

Methodology

Research approach: The study utilised a retrospective case-control approach. Study participants in this type are divided into two categories: those who have the sickness or result of interest ("cases") and those who do not (the "controls"). The amount of exposure each group had to the relevant risk factor is then determined by retrospective analysis. A case reference study is another name for this sort of research.

Study Setting: Patients having a diagnosis of coronary artery disease (the "cases") and those without such a diagnosis (the "controls") were identified and studied in a KDP hospital and a Kotadiya Hospital, respectively.

Samples: Patients admitted to the Medical ICU and Medical Ward at KDP Hospital and Kotadiya Hospital in Rajkot District who underwent lipid profile tests and were between the ages of 26 and 75 made up the samples.

Sample size: The sample size is 100, which is selected at random. There were fifty cases and fifty controls that were matched for age and gender.

Sampling Technique: The purposive sampling method was used in this study.

Inclusion criteria :

Case: People in the study ranged in age from 26 to 75. On the day of data collection, contactable patients are included. Individuals with CAD, whether present or in the past, were subjected to a lipid profile evaluation. Those who have expressed an interest in participating in the study.

Control: People in the study ranged in age from 26 to 75. On the day of data collection, contactable patients are included. Those lack CAD capabilities. People who have expressed interest in participating in the research.

Development Of the Tool:

There are two parts to the tool. These are Sections A and B.

Section A: Participating patients' personal information was sought after in the region. It asks thirteen questions covering your age, gender, residence, religion, marital status, level of education, occupation, monthly income, work type, dietary habits, smoking and drinking history, and any prior illnesses you might have.

Section B: A Lipid Profile analyses the levels of cholesterol (HDL, LDL, and VLDL) and triglycerides (LDL) in the blood. Triglycerides and total cholesterol are also measured. In order to diagnose CAD in this area, the study excluded the value of very low-density lipoprotein and instead used total cholesterol, triglycerides, low-density lipoprotein, and high-density lipoprotein. The study's numerical variables are as follows.

Data Collection Steps:

Phase I: Screening

Between February 4th, 2025, and April 11th, 2025, researchers at KDP and Kotadiya hospitals carried out the study. The elective coordinator was able to secure written approval from the hospital director. Ward sisters and medical records helped sort patients who were eligible for the study into two groups: one to participate in the experiment and another to serve as a control.

Phase II: Data capture and implementation

Patients were given written consent after being informed of the purpose and technique of data collection following sample identification. All information was kept private. Both the cases and the controls participated in the data collection process through the use of structured interviews. Results of lipid profile tests were retrieved from patients' medical records with the assistance of the ward supervisor.

Phase III: Ending

The finished tool was verified. The study's investigator expressed gratitude to the patients, ward sister, and hospital administration for their assent, collaboration, and involvement. Data privacy was assured to patients.

Plan of data analysis:

Using descriptive and inferential statistics, the information gathered from the subjects was collected and analyzed. The research plan shown below was made.

- Frequency and percentage were used to show how the samples were distributed based on background factors.
- Frequency and percentage were used to determine the risk level of CAD and the exposure rate of lipid profiles.
- The Chi-square test was used to find a link between the demographic variables and CAD.
- The Odds Ratio was used to measure the risk.

Results

Data on selected background factors of the participants

Forty percent of the subjects were male and sixty-five percent were between the ages of 56 and 65; the study also included fifty controls. Half of the cases were Hindu and forty percent were Christians in the control group. The majority of cases, 72% to be exact, lived in rural areas, while just 56% of controls did. Among the cases, 30% had finished ninth through twelfth grade, whereas 50% of the controls had a bachelor's degree or above. Compared to the control group, the unemployment rate among patients was 44%. Forty percent of the cases and 36 percent of the controls had monthly incomes between 10,001 and fifteen thousand rupees. Married status (84 percent cases, 70 percent controls), dietary habits (90 percent cases, 76 percent controls), and level of physical activity (40 percent cases, 48 percent controls) were the most common participant characteristics. Cases were more likely to be alcoholics (64% vs. 52%) and less likely to smoke (44% vs. 64%). In cases, the prevalence of comorbidities such as hypertension and diabetes was 36%, while in controls, it was 40%. These results show that CAD patients and controls differ in demographics, socioeconomic status, and lifestyle.

Data on the exposure rate of lipid profile and the risk level of CAD of the participants

Table 1: Frequency and percentage distribution of samples among cases and controls regarding lipid profile.

Lipoproteins	Case(N=50)						Control(N=50)					
	Decreased Value		Normal Value		Increased Value		Decreased Value		Normal Value		Increased Value	
	f	%	f	%	f	%	f	%	f	%	f	%
Total cholesterol	5	10	15	30	30	60	31	62	12	24	7	14
Triglycerides	7	14	9	18	34	68	29	58	13	26	8	16
LDL	9	18	12	24	29	58	34	68	10	20	6	12
HDL	25	50	11	22	14	28	5	10	13	26	32	64

Lipid profiles of cases and controls are presented in table (1). Sixty percent of cases had elevated total cholesterol levels compared to fourteen percent of controls, with sixty-two percent of controls showing normal levels. While 26% of the control group had normal triglyceride levels, 68% of the patients had abnormally high levels compared to 16% of the control group. The percentage of patients with high LDL levels was 58%, compared to 68% of controls who had normal levels. The lipid profiles of the controls were better than those of the cases; for example, 64% of the controls had higher HDL levels. Values were lower in half of the cases. Typically, there are more abnormal lipids in patients compared to controls.

Table 2: Frequency and percentage distribution among cases and controls regarding exposure rate of coronary artery disease.

Lipid Profile score	Case (with CAD)		Control (without CAD)		Total
	f	%	f	%	
1-5	10	20	42	84	52
6-10	40	80	8	16	48
Total	50	100	50	100	100

Scores for lipid profiles are displayed in the table for both CAD cases and controls. While 80% of cases had lipid profiles with scores between 6 and 10, suggesting a higher risk, only 20% had scores between 1 and 5. A better lipid profile was indicated by 84% of the controls having scores between 1 and 5, whereas only 16% had scores between 6 and 10. Higher lipid profile scores in CAD patients compared to the control group suggest worse lipid levels.

Table 3: Shows the mean, standard deviation, and paired "t" test value for both cases and controls.

Group	Mean	SD	df	t value	p value
Case	**8**	**1.72**	**15**	**4.21**	**0.005****
Control	**5**	**1.08**			

Significant p>0.005

Table(3) comparing situations with and without computer-aided design (CAD). Mean score for the case group was 8, with a standard deviation of 1.72, compared to 5 for the control group, with a standard deviation of 1.08. There is a statistically significant difference between the groups, as indicated by the t-value of 4.21 and the p-value of 0.005. Patients with CAD exhibited significantly higher lipid profile scores compared to controls, lending credence to the idea that the two conditions are related.

Information about the participants' assessed risk of CAD and lipid profile.

Table 4: Risk in CAD and lipid profile

Lipid Profile score	**Case (with CAD)**	**Control (without CAD)**	**Total**
	f	**f**	
1-5	10	42	52
6-10	40	8	48
Total	50	50	100

On the table provided, the data suggests a significant relationship between lipid profile scores and the presence of coronary artery disease (CAD) among patients.

In cases with CAD: 80% of patients had lipid profile scores between 6-10, which indicates worse lipid levels. In controls without CAD: 84% had lipid profile scores between 1-5, indicating better lipid profiles.

The Odds Ratio (OR) calculated earlier (0.048) supports that cases with CAD are significantly less likely to have a healthy lipid profile (1-5 score) compared to controls. This suggests that poorer lipid profiles (scores of 6-10) are more commonly associated with the presence of CAD.

Thus, the hypothesis that there is a significant estimated risk in lipid profile and CAD among patients is supported by the data, as the majority of cases with CAD have higher lipid profile scores (6-10), which are linked to a higher risk of cardiovascular events. The calculated odds ratio further strengthens this conclusion, showing a reduced likelihood of having healthy lipid profiles in patients with CAD. There for hypothesis H2: There is significance estimated risk in lipid profile and CAD among patients admitted in selected hospital is accepted.

Information about the link between demographic profile and CAD risk level among cases.

Table 5: Shows the chi-square value for the demographic profile and CAD risk level.

Demographic profile		df	p value	significant
Age	**2.18**	**3**	**7.81**	**S**
Gender	**0.16**	**1**	**3.84**	**NS**
Religion	**1.12**	**2**	**2.74**	**NS**
Education	**5.42**	**3**	**5.21**	**S**
Occupation	**3.54**	**5**	**12.4**	**S**
Monthly Income	**2.54**	**5**	**7.81**	**NS**
Dietary pattern	**4.34**	**4**	**4.15**	**S**
Comorbid disease	**6.25**	**4**	**0.12**	**S**
Smoking history	**1.23**	**6**	**0.15**	**S**
Alcoholic history	**2.01**	**4**	**0.19**	**S**

Significance p>0.05

"There is a significant association between the demographic variables and risk level of CAD among patients admitted in selected hospital." is partially supported by the data. There were statistically significant correlations (p-values less than 0.05) between CAD risk and age, education, dietary pattern, comorbid disease, and smoking history. Crucial factors include age, level of education, and food intake. Nevertheless, there were no significant correlations (p-values greater than 0.05) between gender, religion, monthly income, and alcoholic history and CAD risk in this cohort. There is inconsistent evidence linking certain demographic characteristics to an increased risk of coronary artery disease (CAD), whereas other variables do not.

It was inferred that there was significant association between demographic variables and risk level of CAD among cases. Hence hypothesis 3 was accepted.

Information on more results from this investigation

Table 6: Shows how the samples are spread out by kind of CAD

Coronary Artery Disease	Case (n=50)	
	f	%
MI	32	64
Angina Pectoris	11	22
Congestive Heart Failure	4	8
Ischemic heart disease	3	6
No of patients	50	100

Among fifty individuals, the table shows the prevalence of various coronary artery disorders (CAD). Myocardial infarction (MI) was cited by 64% of the patients, with angina pectoris (22%), congestive heart failure (8%), and ischaemic heart disease (6%) following. This shows that myocardial infarction (MI) is the most prevalent kind of coronary artery disease (CAD) in this population, while angina, heart failure, and ischaemic heart disease impact far smaller percentages.

Table 7 : Shows how samples are spread out based on the lipid profile test and the kind of CAD in the instances.

Scores on lipid profile test	Case (n=50)			
	MI	Angina Pectoris	Congestive Heart Failure	Ischemic heart disease
1-5	10	3	1	2
6-10	22	8	3	1

The table shows lipid profile scores (1–5, 6-10) for 50 patients with different CADs. Among patients with lipid profile scores ranging from 1 to 5, 10 experienced myocardial infarction (MI), 3 had angina pectoris, 1 had congestive heart failure (CHF), and 2 had infarction-related heart disease (IHD). Between 6 and 10 lipid profile scores, 22 cases of MI, 8 cases of Angina Pectoris, 3 cases of CHF, and 1 case of IHD were reported. This suggests that a higher prevalence of MI and more severe coronary artery disease may be linked to higher lipid profile scores.

Discussion

The present case-control study assessed the association between lipid profiles and the risk level of coronary artery disease (CAD) among hospitalized patients in Rajkot. The findings affirm a significant relationship between dyslipidaemia and the presence of CAD, aligning with multiple previous investigations.

In our study, 80% of CAD cases had lipid profile scores between 6–10, compared to only 16% of controls, indicating a strong correlation between lipid abnormalities and CAD. Elevated levels of total cholesterol, triglycerides, and low-density lipoprotein (LDL), along with decreased levels of high-density lipoprotein (HDL), were more common among CAD patients than in controls. This pattern is consistent with prior studies which found that dyslipidaemia, particularly high LDL and low HDL levels, contributes significantly to the development of atherosclerosis and subsequent CAD events .

The increased prevalence of elevated triglycerides and LDL-C in CAD patients also supports the consensus from the European Atherosclerosis Society, which asserts that atherogenic lipoproteins are causally related to atherosclerotic cardiovascular disease . Moreover, our findings reinforce the concept proposed by Walldius and Jungner that the apoB/apoA1 ratio could serve as a more predictive marker of cardiovascular risk than conventional lipid parameters .

Significantly, HDL levels were lower in 50% of CAD cases, supporting evidence that low HDL-C is an independent risk factor, particularly in elderly populations. Denti et al. found that lower HDL-C and HDL-C/ApoAI ratios significantly increased stroke risk in geriatric cohorts, emphasizing the protective role of HDL across various cardiovascular outcomes.

Further, the current study observed that myocardial infarction (MI) was the most prevalent clinical manifestation (64%) among CAD cases with higher lipid scores. This supports previous research indicating that patients with more severe lipid derangements are at increased risk of acute ischemic events .

Demographic variables such as age, education, dietary habits, and smoking showed statistically significant associations with CAD risk in our study, consistent with findings from large cohort studies such as the Framingham Heart Study . Additionally, the link between comorbidities like hypertension and diabetes and CAD was reconfirmed, as these conditions often coexist and exacerbate lipid-related risks .

Wu et al. , in a large-scale Chinese case-control study, also noted gender and age variations in lipid profiles among CAD patients, with significantly higher levels of apoB and lower levels of apoA1 found in patients compared to controls—findings which parallel the trends observed in our Rajkot cohort.

Overall, the statistically significant difference ($p = 0.005$) in mean lipid scores between cases and controls (mean = 8 vs. 5, respectively) and the calculated odds ratio (OR = 0.048) in our study strongly suggest that poor lipid profiles are associated with increased CAD risk.

Ethical Consideration

This investigation considered ethics. The college research ethics committee of SMT M.Y patel mahila nursing college and KDP hospital ethical committee members approved the study with the reference number(SMT/CON/2024/ETI142/5). The patients and ward incharge were told of the study's purpose after hospital approval. We acquired written consent and pledged secrecy. Participants could opt out of the trial. No hospital employee routines are hidden. There were no invasive procedures in the trial. Physical and mental pain were missing. Ethics were maintained in the study.

Funding :

There is no funding.

Recommendations

The study's results have led to numerous suggestions for how coronary artery disease (CAD) might be better understood and treated. The first step in making these findings more robust and applicable to a broader population is to repeat the research with a larger sample. Furthermore, by comparing CAD prevalence and risk variables in different healthcare environments, such as public and private institutions, the study can shed light on any discrepancies. Since lifestyle and access to healthcare differ greatly between rural and urban populations, it is therefore crucial to investigate whether there is a difference in the prevalence of CAD between the two. In order to enhance patient education and care, it is crucial to conduct study among staff nurses to measure their understanding about CAD and its risk factors. Lastly, to aid in the development of effective intervention and prevention methods, a comparative assessment of the several risk factors causing CAD would be helpful in identifying the most important contributions. The management and comprehension of CAD in various

demographics and healthcare settings should be greatly improved by these enlarged investigations.

Limitations

The study has various drawbacks that limit its generalisability and dependability. First, just two hospitals were included, therefore the sample may not be typical of the general community due to its patient demographics and practices. This limits the study's external validity because the findings may not apply to other contexts or locations with different healthcare systems. Second, the study relied primarily on the researcher's personal experience, which may create bias. This approach may lack rigour and objectivity for more accurate and reproducible outcomes because personal experience is subjective and may influence data interpretation and conclusions. Another drawback is the tiny sample size. The study's sample of 50 cases may not fully represent the population's diversity, reducing statistical power and making it hard to detect minor effects or make conclusions. The small sample size increases the danger of sampling bias, where the participants may not represent the population. The study's findings are further weakened by the lack of random sampling. Selection bias, where some groups are over-represented or under-represented, may affect outcomes without random selection. Without random sampling, causal inferences and research reliability are limited. These limitations suggest that the findings should be evaluated cautiously and that more research with a bigger sample size, more diverse settings, and random sampling methods is needed to draw firmer conclusions.

Conclusion

This case-control study aims to provide valuable insights into the relationship between lipid profiles and CAD risk among hospitalized patients. By elucidating key differences in lipid metabolism between cases and controls, the findings may enhance risk prediction models and inform personalized treatment strategies. Given the global burden of CAD, such research is essential for improving patient outcomes and reducing cardiovascular mortality.

Abbreviation list

- CAD- Coronary Artery Disease
- HDL- High-Density Lipoprotein
- LDL- Low-Density Lipoprotein
- HDL-C- High-Density Lipoprotein Cholesterol

- LDL-C- Low-Density Lipoprotein Cholesterol
- TG- Triglycerides
- TC-Total Cholesterol
- ICU- Intensive Care Unit
- VLDL- Very Low-Density Lipoprotein
- Apo A-1-Apolipoprotein A1
- ApoB-Apolipoprotein B
- OR- Odd ratio

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