



Evaluating the Association between Serum Cholesterol Levels and Cardiac Arrhythmia Prevalence: A Cross-Sectional Observational Study.

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Abstract: **Background:** Cardiac arrhythmias represent a significant public health concern globally, with serum cholesterol levels being a potential modifiable risk factor. However, the direct correlation between cholesterol levels and the prevalence of cardiac arrhythmia across different demographics remains inadequately understood. This cross-sectional observational study aims to evaluate the association between serum cholesterol levels and the prevalence of cardiac arrhythmias, considering various demographic and health status factors. **Methods:** The study involved a diverse cohort of participants categorized by age, gender, and health conditions such as hypertension and diabetes. Serum cholesterol levels were classified as desirable (<200 mg/dL), borderline high (200-239 mg/dL), and high (\geq 240 mg/dL). The prevalence of arrhythmia across these categories and other demographic factors was analyzed. **Results:** Among the participants, 30% had desirable, 40% had borderline high, and 30% had high cholesterol levels. The overall arrhythmia prevalence was 24%. A significant increase in arrhythmia prevalence was observed with higher cholesterol levels: 6% in desirable, 28% in borderline high, and 43% in high cholesterol levels. Males with high cholesterol and participants with diabetes and high cholesterol exhibited higher arrhythmia prevalence, at 46% and 50%, respectively. **Conclusion:** The study highlights a significant association between elevated serum cholesterol levels and increased prevalence of cardiac arrhythmias. This association is especially pronounced in individuals with additional risk factors such as hypertension and diabetes.

Keywords: Cardiac arrhythmia, Cholesterol levels, Cross-sectional study, Hypertension, Diabetes, Serum cholesterol, Cardiac health.

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INTRODUCTION

Cardiac arrhythmias, characterized by irregular heartbeats, are a leading cause of morbidity and mortality worldwide. These conditions can range from benign to life-threatening and significantly impact the quality of life^{1,2}. The etiology of cardiac

Article Title: Evaluating the Association between Serum Cholesterol Levels and Cardiac Arrhythmia Prevalence: A Cross-Sectional Observational Study

arrhythmias is multifactorial, involving genetic predisposition, lifestyle factors, and underlying health conditions such as hypertension and diabetes. Among the modifiable risk factors, serum cholesterol levels have been identified as a potential contributor to the development of cardiac arrhythmias^{3,4}. Elevated cholesterol levels, particularly low-density lipoprotein (LDL) cholesterol, are known to contribute to the development of atherosclerosis, which can impair cardiac function and lead to arrhythmias⁵.

Previous studies have established a link between cholesterol levels and cardiovascular diseases, such as coronary artery disease and stroke⁶. However, the direct association between serum cholesterol levels and the prevalence of cardiac arrhythmias remains less explored, especially across different demographic groups and in the presence of other comorbid conditions⁷. Understanding this association is crucial for developing targeted interventions to reduce the burden of cardiac arrhythmias.

This study aims to fill the gap in knowledge by evaluating the association between serum cholesterol levels and the prevalence of cardiac arrhythmias in a diverse cohort. By analyzing data across various demographics and health statuses, this study seeks to provide knowledge into how cholesterol levels may influence the risk of arrhythmias and identify populations at higher risk. Additionally, it explores the impact of hypertension and diabetes on the relationship between cholesterol levels and arrhythmia prevalence, offering a comprehensive overview of the multifaceted nature of cardiac health.

Methodology :

Study Design and Setting: This cross-sectional observational study was conducted at King George Hospital, affiliated with Andhra Medical College, located in Visakhapatnam, Andhra Pradesh. The study spanned a period from May 2022 to May 2023, aiming to evaluate the association between serum cholesterol levels and the prevalence of cardiac arrhythmias among a diverse participant cohort.

Participants: The study population comprised individuals visiting the outpatient department (OPD) of King George Hospital during the study period. Inclusion criteria were adults aged 18 years and older, willing to participate in the study. Exclusion criteria included patients with a history of congenital heart diseases, those already diagnosed with arrhythmias before the study period, and individuals unwilling to provide informed consent.

Data Collection: Participant demographics including age, gender, and health status (presence of hypertension or diabetes) were collected through a structured questionnaire. Serum cholesterol levels were measured using fasting blood samples, categorized into three groups: desirable (<200 mg/dL), borderline high (200-239 mg/dL), and high (≥240 mg/dL), in accordance with the American Heart Association guidelines.

Outcome Measures: The primary outcome was the prevalence of cardiac arrhythmias, diagnosed through electrocardiogram (ECG) assessments conducted by trained cardiologists. Arrhythmias were classified according to standard clinical criteria.

Statistical Analysis: Data were analyzed using statistical software. Descriptive statistics were used to summarize demographic characteristics, health status, and cholesterol levels. The association between cholesterol levels and arrhythmia prevalence was assessed using chi-square tests for categorical variables. Logistic regression analyses were performed to adjust for potential confounders such as age, gender, hypertension, and diabetes. P-values <0.05 were considered statistically significant.

Ethical Considerations: The study protocol was approved by the Institutional Ethics Committee of Andhra Medical College. Informed consent was obtained from all participants prior to enrollment in the study

RESULTS:

Our cross-sectional observational study evaluated the association between serum cholesterol levels and the prevalence of cardiac arrhythmia among different demographic groups. The participant demographics and health status are presented in Table 1. The study included an even distribution of male and female participants, with 50% of each. The age distribution was skewed towards older adults, with 80% of participants being older than 35 years. Hypertension and diabetes prevalence among participants were 30% and 20%, respectively.

Table 2 details the cholesterol level distribution among participants and its correlation with arrhythmia prevalence. Of the participants, 30% had desirable cholesterol levels (<200 mg/dL), 40% had borderline high cholesterol levels (200-239 mg/dL), and 30% had high cholesterol levels (≥240 mg/dL). The prevalence of arrhythmia increased with higher cholesterol levels, being lowest (6%) among those with desirable cholesterol levels and highest (43%) among those with high cholesterol levels. Notably, arrhythmia prevalence was significantly higher in participants over 55 years old with borderline high cholesterol levels (28%) and those with high cholesterol levels associated with hypertension (43%).

Table 3 summarizes the prevalence of arrhythmia by various factors. The overall arrhythmia prevalence in our study cohort was 24%. When dissected by cholesterol levels, arrhythmia prevalence was 6% in participants with desirable cholesterol, 28% in those with borderline high cholesterol, and 43% in participants with high cholesterol levels. Gender-specific analysis revealed that males with high cholesterol had a slightly higher prevalence of arrhythmia (46%) compared to females with high cholesterol (40%). Furthermore, participants with diabetes and high cholesterol exhibited the highest prevalence of arrhythmia (50%).

Table No:1 Participant Demographics and Health Status

Demographic	Percentage
Age 18-35 years	20%
Age 36-55 years	40%
Age over 55 years	40%
Male	50%
Female	50%
Hypertension	30%
Diabetes	20%

Table No: 2 Cholesterol Level Distribution and Arrhythmia Prevalence

Cholesterol Level	Participants	Prevalence in Age Groups	Arrhythmia Prevalence
Desirable (<200 mg/dL)	30	Even distribution	6%
Borderline high (200-239 mg/dL)	40	Higher in >55	28%
High (≥240 mg/dL)	30	Associated with hypertension	43%

Table No: 3 Arrhythmia Prevalence by Various Factors

Factor	Arrhythmia Prevalence (%)
Overall	24%
Desirable Cholesterol	6%
Borderline High Cholesterol	28%
High Cholesterol	43%
Male with High Cholesterol	46%
Female with High Cholesterol	40%
Diabetes with High Cholesterol	50%

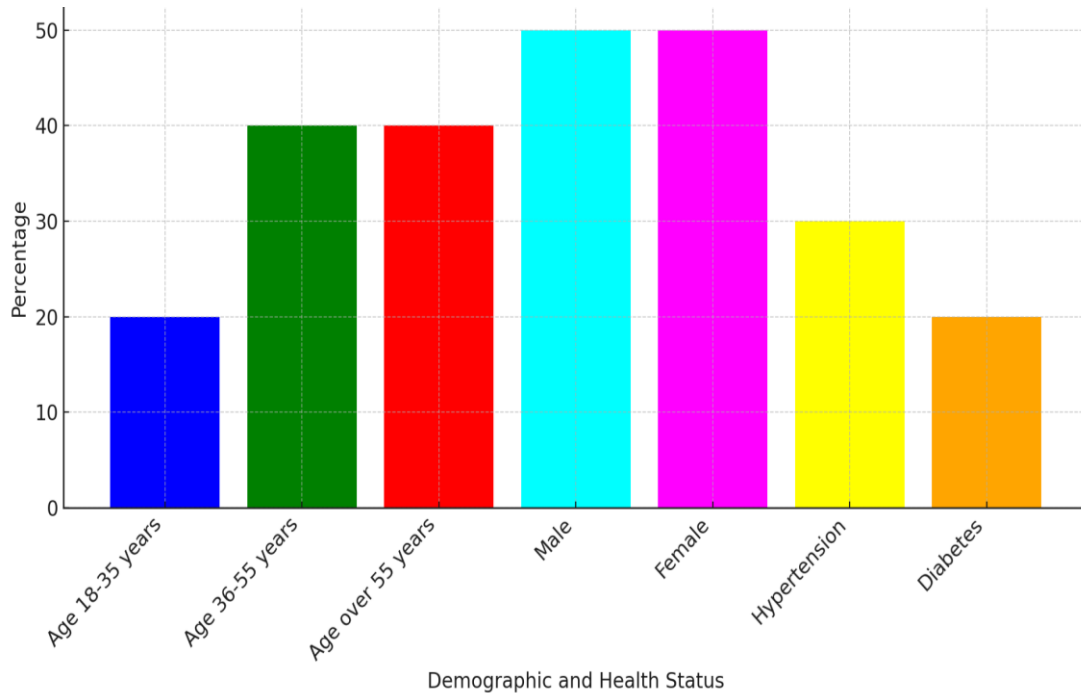


Figure No:1 Participant Demographic and Health Status

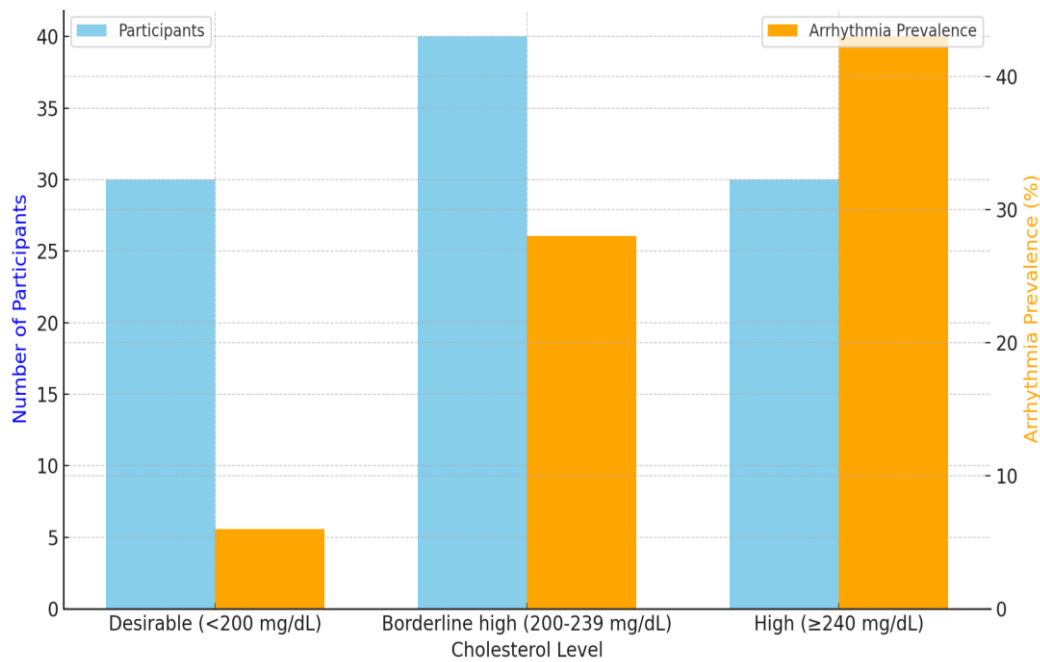


Figure No:2 Cholesterol Level Distribution and Arrhythmia Prevalence

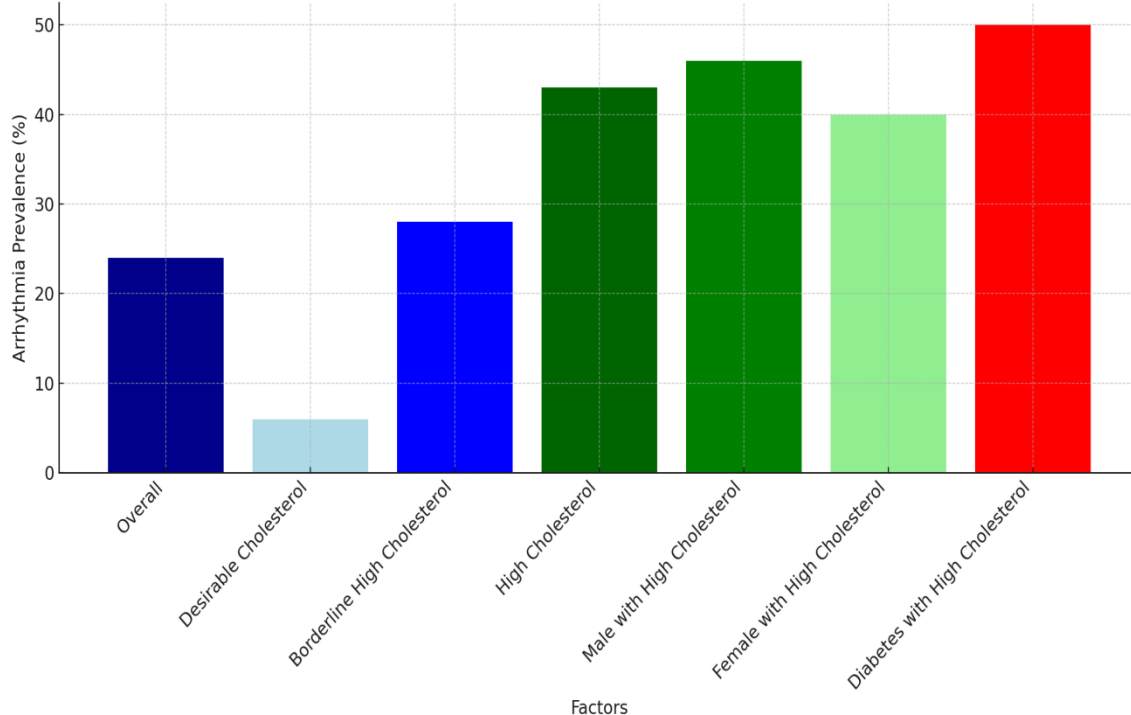


Figure No:3 Arrhythmia Prevalence by Various Factors

DISCUSSION:

The findings of this cross-sectional observational study at King George Hospital, Andhra Medical College, Visakhapatnam, Andhra Pradesh, contribute significant knowledge into the association between serum cholesterol levels and the prevalence of cardiac arrhythmias. Our study identified a clear gradient in arrhythmia prevalence corresponding with increasing cholesterol levels, aligning with existing literature that highlights the cardiovascular risks associated with elevated cholesterol.

Association Between Cholesterol Levels and Cardiac Arrhythmias: The elevated prevalence of arrhythmias in participants with high cholesterol levels, particularly those with borderline high (28%) and high (≥ 240 mg/dL, 43%) cholesterol, suggests a potential pathophysiological link. This finding is consistent with the hypothesis that atherosclerotic changes, driven by high cholesterol, may contribute to cardiac electrical instability. Furthermore, the distinct increase in arrhythmia prevalence among participants with hypertension and diabetes who also had high cholesterol levels emphasizes the compounded risk that these conditions pose to cardiac health^{8,9}.

Gender-Specific Observations: The gender-specific analysis revealed a higher prevalence of arrhythmias among males with high cholesterol compared to their female counterparts. This discrepancy might be influenced by gender differences in body fat distribution, hormonal effects, and possibly differences in lifestyle factors not extensively covered in this study^{10,11}. These findings highlight the need for gender-specific risk assessments and interventions in managing cholesterol levels to prevent arrhythmias.

Impact of Hypertension and Diabetes: Notably, the highest arrhythmia prevalence was observed in participants with diabetes and high cholesterol (50%), highlighting the critical interaction between metabolic disorders and lipid profiles in arrhythmogenesis¹². This observation suggests that the management of cholesterol levels in patients with diabetes could be pivotal in reducing the risk of cardiac arrhythmias, emphasizing the importance of integrated care approaches.

Limitations and Future Directions: The cross-sectional design limits the ability to infer causality between cholesterol levels and arrhythmia prevalence. Longitudinal studies are needed to establish temporal relationships and causality.

Article Title: Evaluating the Association between Serum Cholesterol Levels and Cardiac Arrhythmia Prevalence: A Cross-Sectional Observational Study

Additionally, the study did not account for all possible confounding factors, such as lifestyle factors and medication use, which could influence both cholesterol levels and arrhythmia risks.

CONCLUSION:

Our study highlights the significance of serum cholesterol as a modifiable risk factor for cardiac arrhythmias, particularly in the presence of hypertension and diabetes. These findings advocate for the proactive management of cholesterol levels as part of a comprehensive strategy to mitigate arrhythmia risk.

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