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Original Article

Correlation of C- Reactive Protein (CRP) and Lipid Profile Among Patients of Ischemic Heart Disease (IHD) and Non-Ischemic Heart Disease Patients

Muhammad Shahzad Anwer, Usama Bin Khalid*, Sara Khan, Shamshad Ali, Mohsin Hussain Nizamani, Rabia Saeed****

Department of Pathology, Combined Military Hospital, Bahawalpur/National University of Medical Sciences (NUMS) Pakistan,
*Department of Pathology, Combined Military Hospital, Dera Nawab Sahib/National University of Medical Sciences (NUMS) Pakistan,
**Department of Pathology, Combined Military Hospital/Institute of Medical Sciences Bahawalpur/National University of Medical Sciences (NUMS) Pakistan

ABSTRACT

Objective: To determine correlation of C-reactive protein with lipid profile among patients of ischemic heart disease (IHD) and non-ischemic heart disease (non-IHD) and to determine association of CRP with dyslipidemia in IHD and non-IHD patients.
Place and Duration of Study: Combined Military Hospital, Bahawalpur Pakistan, from Apr 2023 to Dec 2023.
Study Design: Comparative cross sectional study.
Methodology: A total of 252 patients were enrolled in this study (159 patients of IHD and 93 non-IHD patients). Quantitative CRP and serum Lipid Profile were assayed on fully automated chemistry analyzer Cobas c501 by Roche®. Pearson correlation technique was applied to determine correlation. Chi square test was used to find any significant association between CRP and both IHD and non-IHD groups.
Results: Out of 252 patients, 159(63.1%) had IHD, while 93(36.9%) had no history of IHD. For IHD group mean of total cholesterol, triglycerides, LDL-cholesterol, HDL-cholesterol and CRP were 5.71±0.70 mmol/L, 2.48±0.79 mmol/L, 3.03±0.60 mmol/L, 1.11±0.25 mmol/L and 11.04±5.92 mg/L respectively. Pearson correlation coefficient (r) between CRP and total cholesterol, TG, LDL-cholesterol and HDL-cholesterol were 0.84, 0.46, 0.73 and -0.79 for IHD group, while these were 0.42, 0.02, 0.29 and - 0.38 respectively for non-IHD group. Strong association of CRP among IHD and Non-IHD groups with dyslipidemia was observed (p<0.001).
Conclusion: Positive correlation between CRP and total cholesterol, TG, LDL-cholesterol was observed in IHD group. Association between CRP and dyslipidemia is a significant finding in both ischemic and non-ischemic heart disease patients.

Keywords: Cholesterol, C - reactive protein, Dyslipidemia, Ischemic heart disease.

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INTRODUCTION

It is believed that metabolic abnormalities and cardiovascular disease (CVD), such as coronary heart disease and cerebrovascular illness, are influenced by chronic inflammation. Additionally, it has been proposed that persistent low-grade inflammation plays a significant role in the development of metabolic syndrome (MetS) and the clinical outcomes that follow.[1] Chronic low-intensity inflammation is also associated with changes in the vascular endothelium's glycocalyx brought on by CRP, which leads to malfunction and increases the endothelium's susceptibility to proatherogenic stimuli.[2] Biomarkers that aid in the detection of inflammation-induced vascular alterations are particularly helpful, as cardiac imaging tools are unable to identify these changes. Techniques that can precisely and reliably identify individuals who are at risk of developing cardiovascular problems are also desperately needed. Serum CRP is a biomarker of inflammation that could fit these requirements. The blood concentration of CRP in healthy persons typically does not rise over 6 mg/L; however, it can increase up to 1000 times after stimulation.[3,4] CRP levels can be easily, quickly, and affordably measured in samples since it is stable over an extended period of time. Numerous variables, such as the patient's age, sex, race, ethnicity, hormonal state, obesity, smoking, alcohol consumption, food, presence of infectious agent, length of disease, comorbidities, medication intake/ingestion, and genetic polymorphisms, affect the baseline level of this protein.[5] Higher CRP levels have been linked to an increased risk of cardiovascular disease in both individuals with existing illness and those at risk of atherosclerosis, according to several prospective cohort studies.[6,7]

Correspondence: Dr Usama Bin Khalid, Department of Pathology, Combined Military Hospital, Dera Nawab Sahib Pakistan
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The relationship between CRP and dyslipidemia has been studied in few studies where it has been found associated with development of atherosclerosis and ischemic heart disease.[8,9] However, this association may differ in different populations and needs to be evaluated in underserved societies.

Our study aims to find association of CRP with ischemic heart disease in local population and the level of correlation between CRP and different parameters of lipid profile. The outcomes of the study may enable clinicians to use CRP as an important adjunctive tool for diagnosis and monitoring of treatment of dyslipidemias in patients of ischemic heart disease and in general population with dyslipidemia.

METHODOLOGY

This comparative cross sectional study was conducted at the Department of Chemical Pathology, Combined Military Hospital, Bahawalpur, Pakistan from April 2023 to December 2023 after the approval of hospital ethical review committee (EC-17-2023). The sample size was calculated by WHO calculator taking prevalence of ischemic heart disease in Pakistan 17% as per WHO data,[10] at 95% confidence interval with 5% margin of error. Consecutive sampling technique was employed and a structured proforma was designed according to inclusion and exclusion criteria.

Inclusion Criteria: Non-diabetic dyslipidemic patients of either gender who reported to clinical laboratory for blood samples from both medical and emergency outpatient departments with history of chest pain and demonstrated features of ischemic heart disease either biochemically or on ECG and also the patients who were known cases of ischemic heart disease (IHD) on follow up visits and patients with dyslipidemia without IHD were included in the study.

Exclusion Criteria: Patients who had a known infection or symptoms of inflammatory conditions like COVID-19, acute and chronic tonsillitis, upper and lower respiratory tract infections, gastroenteritis, urinary tract infections, rheumatoid arthritis and other inflammatory conditions. Patients of diabetes mellitus (DM) and chronic infectious diseases were also excluded as these are confounding factors and may cause alterations in CRP levels and dyslipidemias.

Patients were selected by consecutive sampling and detailed medical history was taken before phlebotomy and findings were noted on a standard questionnaire after formal approval from the institutional ethics committee and after obtaining informed consent from the patients. 05 ml of blood sample was collected from every patient in clot activator vaccutainer tube with gel in a laboratory under aseptic techniques. Samples were centrifuged at 3500 revolutions per minute (RPM) for 5 minutes and serum was separated. Hemolyzed and icteric samples were rejected after visual inspection due to possible interferences. Samples for lipid profile was assayed on fully automated random access chemistry analyzer Roche® Cobas c501 using spectrophotometric methods. The parameters for lipid profile included, total cholesterol (T-Chol), triglycerides (TG), low density lipoproteins cholesterol (LDL-C) and high density lipoproteins cholesterol (HDL-C). The method of analysis for lipid profile parameters was homogenous enzymatic colorimetric assay while CRP was assayed by particle enhanced immunoturbidimetric principle. For quality control, Lyphochek® assayed chemistry controls by BIO-RAD were run daily. To ensure quality control, Westgard multirules were applied.

All results were entered on statistical package for social sciences (SPSS) version 21. Normality of data was assessed was Kolmogorov-Smirnov test. Descriptive variables were computed as Mean±SD for age and gender. Independent sample t-test was employed to find any significant difference in CRP and lipid profile between IHD and non-IHD group. Pearson correlation technique was applied to determine correlation between CRP and different parameters of lipid profile. Chi square test was used to find any significant association between serum CRP levels and lipid profile in both patient groups (IHD patients and non-IHD patients). $p<0.05$ was taken as statistically significant.

RESULTS

Out of 252 patients, 140(55.6%) were male and 112(44.46%) were female. Mean age was 45.04±13.07 years. 159(63.1%) had IHD, while 93(36.9%) had no history of IHD. The majority of patients i.e. 157(62.3%) belonged to urban background while 95(37.7%) had a rural origin. For IHD group mean total cholesterol, triglycerides, LDL-cholesterol, HDL-cholesterol and CRP were 5.71±0.70 mmol/L, 2.48±0.79 mmol/L, 3.03±0.60 mmol/L, 1.11±0.25 mmol/L and 11.04±5.92 mg/L respectively. For non-IHD group these were 5.74±0.72 mmol/L, 2.48±1.25 mmol/L, 3.11±0.71 mmol/L, 1.17±0.31 mmol/L and 8.79±5.69 mg/L respectively. (Table-I)

Correlation between CRP and different parameters of lipid profile was determined by Pearson Correlation technique. A strong positive correlation was noted between CRP and total Cholesterol while strong negative correlation was seen between CRP and HDL cholesterol. Pearson correlation coefficient (r) between CRP and total cholesterol, TG, LDL-cholesterol and HDL-cholesterol were 0.84, 0.46, 0.73 and -0.79 for IHD group, while these were 0.42, 0.02, 0.29 and - 0.38 respectively for non-IHD group (Table-II). Figure-1 depicts graphical representation of correlation between CRP and lipid profile in patients of IHD. Moreover, strong association of CRP with IHD was observed (p<0.001) by using Chi square test.

Table-I: Comparison of age, C-reactive Protein and Lipid Profile Parameters in Ischemic Heart Disease (IHD) and Non-Ischemic Heart Disease (non-IHD) Patients (n=252)

Parameter	IHD (n=159)	Non-IHD (n=93)	p-value
Age (years)	45.11±13.49	44.92±12.39	0.91
CRP (mg/L)	11.04 ± 5.92	8.79±5.69	0.004
Total Cholesterol (mmol/L)	5.71±0.70	5.74±0.72	0.68
Triglycerides (mmol/L)	2.48±0.79	2.48±1.25	0.97
LDL Cholesterol (mmol/L)	3.03 ± 0.60	3.11±0.71	0.38
HDL Cholesterol (mmol/L)	1.11 ± 0.25	1.17 ± 0.31	0.08

Table-II: Correlation Between C-reactive Protein (CRP) and Different Parameters of Lipid Profile in Ischemic Heart Disease (IHD) and Non-ischemic Heart Disease (non-IHD) Patients (n=252)

	Pearson coefficient (r) in IHD group (n=159)	Pearson coefficient (r) in Non-IHD group (n=93)
Total Cholesterol (mmol/L)	0.84	0.42
Triglycerides (mmol/L)	0.46	0.02
LDL Cholesterol (mmol/L)	0.73	0.29
HDL Cholesterol (mmol/L)	-0.79	- 0.17

DISCUSSION

It has long been known that the genesis of cardiovascular illnesses, such as ischemic heart disease (IHD), is significantly influenced by the interaction between inflammation and dyslipidemia.[11] This work highlights the significance of CRP as a potential biomarker for assessing the level of inflammation in IHD patients. Elevated CRP levels have long been associated with an increased risk of cardiovascular events. By examining the intricate connection between CRP and dyslipidemia, the study sheds light on the possibility that inflammation plays a role in the lipid abnormalities associated with IHD.[12-14]

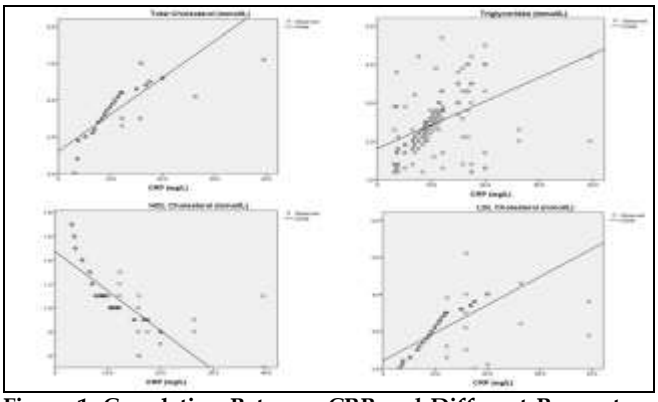

Figure-1: Correlation Between CRP and Different Parameters of Lipid Profile Among Patients of IHD (n=159)

In our study, strong positive correlation was noted between CRP and Total Cholesterol (r=0.84) while strong negative correlation was seen between CRP and HDL cholesterol (-0.79) in the IHD group. These findings are substantiated by earlier studies. A study by Waheed et al demonstrated similar findings i.e. a positive correlation (r=0.80) between total cholesterol and CRP while negative correlation between HDL-Cholesterol and CRP (r=-0.10).[15] But this study included patients of diabetes mellitus which is a pro-inflammatory condition and is accompanied by dyslipidemias. However, our study did not include patients of diabetes mellitus which makes this correlation more important and establishes the association of CRP and dyslipidemia (p<0.001).

In another study conducted in India by Chianeh et al similar findings were observed i.e. significant correlation of CRP with TG (r=0.673), LDL (r=0.705) and HDL (r=−0.819).[16] Comparing these findings with our study, the findings of our study demonstrated correlation between CRP and TG, LDL and HDL as r=0.46, r=0.73. r=-0.79 respectively.

One of the significant implications of this research lies in its potential impact on clinical practice. The correlation between CRP and dyslipidemia was observed (p<0.001) which suggests that monitoring both inflammatory markers and lipid profiles in IHD patients could provide a more comprehensive assessment of cardiovascular risk. Similarly it has been demonstrated earlier in a Korean study by Jeong *et al.*, where a strong association was established between

CRP and dyslipidemia ($p<0.001$).[17] Tailoring treatment strategies to address both inflammation and dyslipidemia may offer a more targeted approach to managing IHD, potentially improving patient outcomes.

The study offers insightful information, yet there are still some problems and unanswered questions. More research is necessary to understand the causal processes behind the temporal association between elevated CRP and the start of dyslipidemia. Furthermore, investigating the possible usefulness of CRP as a cardiovascular event predictive marker in the setting of dyslipidemia may prove to be a lucrative research topic in the future.

CONCLUSION

Positive correlation was observed between CRP and total cholesterol, TG, LDL-cholesterol in IHD group. Association between CRP and dyslipidemia is a significant finding in both ischemic and non-ischemic heart disease patients. Therefore, lipid profile results should be cautiously interpreted in acute inflammatory conditions.

RECOMMENDATIONS

This study adds to our understanding of the complicated interaction between CRP and dyslipidemia in the setting of Ischemic Heart Disease. The results highlight the necessity of a comprehensive strategy for evaluating cardiovascular risk that takes into account of both lipid profiles and inflammatory markers. In order to minimize the effects of dyslipidemia in IHD patients, more studies in this field may open the doors to innovative treatment approaches and tailored treatments, which might enhance long-term results.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MSA & UBK: Data acquisition, data analysis, critical review, approval of the final version to be published.

SK & SA: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

MHN & RS: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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