Evaluating The Role of Fibrinogen As An Independent Risk Factor in Coronary Heart Disease

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Abstract

Objective: Fibrinogen is a plasma glycoprotein involved in blood coagulation and acts as an acute-phase inflammatory protein. Elevated fibrinogen concentrations have been associated with atherosclerosis, thrombosis, and cardiovascular events. The objective of this study is to estimate plasma fibrinogen levels among patients with coronary heart disease and healthy controls, compare fibrinogen concentrations between the two groups, and determine the association between elevated fibrinogen levels and coronary heart disease. The study will also assess whether fibrinogen may serve as an independent risk factor and potential biomarker for coronary heart disease.

Methods: This comparative cross-sectional study included 200 adults divided into two groups of 100: healthy controls and patients with coronary heart disease. Participants were classified based on total cholesterol and lipid profile levels. Plasma fibrinogen levels were measured and compared between the groups using an independent-samples t-test. The association between coronary heart disease and fibrinogen levels was evaluated using Pearson correlation analysis.

Results: The mean fibrinogen concentration was substantially higher in the case group (459.82 ± 7.37 mg/dL) than in the control group (294.30 ± 54.40 mg/dL), and the difference was statistically significant ($p < 0.001$). Similarly, total cholesterol was significantly higher among cases (280.12 ± 4.72 mg/dL) compared with controls (172.66 ± 14.19 mg/dL; $p < 0.001$).The mean LDL concentration was also significantly elevated in cases (135.64 ± 5.77 mg/dL) compared with controls (79.92 ± 11.38 mg/dL; $p < 0.001$). In contrast, HDL concentrations were significantly lower among cases (26.29 ± 3.23 mg/dL) than among controls (44.75 ± 3.16 mg/dL; $p < 0.001$).

Conclusion: According to the study's findings, patients with coronary heart disease may have higher plasma fibrinogen levels than healthy controls. The results point to a possible link between coronary heart disease and elevated fibrinogen levels. As a result, plasma fibrinogen could be a helpful biomarker for determining cardiovascular risk.

Keywords: Coronary heart disease ; Blood Coagulation Tests: Fibrinogen; Lipid profile ; Total cholesterol.

Introduction

Coronary heart disease (CHD) is one of the leading causes of morbidity and mortality worldwide and is primarily associated with atherosclerosis and thrombosis. The development and progression of CHD are influenced by several conventional risk factors, including age, smoking, hypertension, diabetes mellitus, obesity, and abnormal lipid levels. Identification of additional biomarkers may improve the early assessment of individuals at increased cardiovascular risk.[1,2]

Fibrinogen is a soluble plasma glycoprotein that plays an important role in the coagulation process by being converted into fibrin during blood clot formation. It also functions as an acute-phase inflammatory protein and may reflect underlying systemic inflammation. Increased plasma fibrinogen levels have been associated with endothelial dysfunction, platelet aggregation, atherosclerosis, and thrombotic events. Consequently, elevated fibrinogen may contribute to the development and progression of coronary heart disease.[3,4]

Several studies have reported higher fibrinogen concentrations among patients with cardiovascular disease compared with healthy individuals. However, the extent to which fibrinogen independently contributes to CHD risk after considering conventional cardiovascular risk factors remains an important area of investigation. Therefore, this study aims to estimate and compare plasma fibrinogen levels among patients with coronary heart disease and healthy controls and to evaluate the association between fibrinogen levels and coronary heart disease[5,6]

Materials and Methods

This investigation employed a comparative, cross-sectional design and was undertaken at a tertiary care hospital in Kerala, India. Study participants were recruited based on their lipid profile level and fibrinogen level and stratified into two cohorts of 100 each: normal controls and patients newly diagnosed with coronary heart disease . Participants with acute or chronic inflammatory or infectious diseases, bleeding or coagulation disorders, liver or renal disease, malignancy, or autoimmune disorders will be excluded. Individuals receiving anticoagulant or fibrinolytic therapy, pregnant women, and those with a recent history of major surgery, trauma, or acute

myocardial infarction will also be excluded. Participants who are unwilling to provide informed consent or have incomplete clinical or laboratory data will not be included in the study.
Following informed consent, venous blood specimens were obtained for the assessment of plasma fibrinogen , total cholesterol and plasma lipid profile using standard laboratory techniques. Statistical analysis was performed using SPSS (Version 29), and continuous variables were reported as mean ± standard deviation.
Results
A total of 200 participants were included in the analysis, comprising 100 cases and 100 controls. The biochemical parameters demonstrated marked differences between the two groups.
The mean fibrinogen concentration was substantially higher in the case group (459.82 ± 7.37 mg/dL) than in the control group (294.30 ± 54.40 mg/dL), and the difference was statistically significant ($p < 0.001$). Similarly, total cholesterol was significantly higher among cases (280.12 ± 4.72 mg/dL) compared with controls (172.66 ± 14.19 mg/dL; $p < 0.001$).
The mean LDL concentration was also significantly elevated in cases (135.64 ± 5.77 mg/dL) compared with controls (79.92 ± 11.38 mg/dL; $p < 0.001$). In contrast, HDL concentrations were significantly lower among cases (26.29 ± 3.23 mg/dL) than among controls (44.75 ± 3.16 mg/dL; $p < 0.001$).
Triglyceride concentrations were significantly higher in the case group (163.82 ± 2.72 mg/dL) than in the control group (115.12 ± 20.15 mg/dL; $p < 0.001$). Likewise, VLDL concentrations were significantly higher among cases (32.90 ± 2.26 mg/dL) compared with controls (14.88 ± 9.15 mg/dL; $p < 0.001$).
The case group demonstrated a consistently unfavorable biochemical profile, characterized by higher fibrinogen, total cholesterol, LDL, triglycerides, and VLDL concentrations and lower HDL concentrations compared with the normal control group. All between-group differences reached statistical significance at $p < 0.001$.
Pearson correlation analysis demonstrated strong associations between fibrinogen and the lipid parameters in the combined study population. Fibrinogen showed positive associations with total cholesterol, LDL, triglycerides, and VLDL, whereas an inverse association was observed with HDL.

Discussion

Coronary heart disease (CHD) is a multifactorial cardiovascular disorder in which atherosclerosis, inflammation, endothelial dysfunction, and thrombosis interact to determine disease development and clinical outcomes. Although conventional risk factors such as dyslipidemia, hypertension, diabetes mellitus, smoking, and obesity are well established, increasing attention has been directed toward circulating biomarkers that may provide additional information regarding cardiovascular risk. Fibrinogen is of particular interest because it plays an important role in both coagulation and inflammation. The present study evaluated fibrinogen levels in patients with CHD and normal controls and examined their relationship with lipid profile parameters.In the present analysis, fibrinogen concentrations were substantially higher in the case group than in the control group. The mean fibrinogen concentration was 459.82 ± 7.37 mg/dL in cases compared with 294.30 ± 54.40 mg/dL in controls, with a statistically significant difference ($p < 0.001$). This finding supports the hypothesis that increased fibrinogen is associated with CHD. The magnitude of the difference between the two groups suggests that fibrinogen may reflect an important component of the biological processes accompanying coronary disease.[7,8]

Fibrinogen is synthesized predominantly by the liver and increases in response to inflammatory stimuli as an acute-phase reactant. During coagulation, fibrinogen is converted to fibrin, which forms the structural framework of a thrombus. Increased fibrinogen concentrations may therefore promote thrombosis by increasing blood viscosity, enhancing platelet aggregation, and contributing to the formation of a fibrin network. In patients with atherosclerotic coronary arteries, these effects may increase the likelihood of thrombus formation following disruption of an atherosclerotic plaque.[9,10,11,12]

The present study also demonstrated significant differences in lipid parameters between cases and controls. Cases had higher total cholesterol (280.12 ± 4.72 mg/dL versus 172.66 ± 14.19 mg/dL), LDL (135.64 ± 5.77 mg/dL versus 79.92 ± 11.38 mg/dL), triglycerides (163.82 ± 2.72 mg/dL versus 115.12 ± 20.15 mg/dL), and VLDL (32.90 ± 2.26 mg/dL versus 14.88 ± 9.15 mg/dL). HDL was substantially lower in cases (26.29 ± 3.23 mg/dL) than in controls (44.75 ± 3.16 mg/dL). All these differences were statistically significant ($p < 0.001$). This pattern is consistent with the established contribution of an atherogenic lipid profile to CHD.

The coexistence of elevated fibrinogen and an unfavorable lipid profile is particularly relevant when considering fibrinogen as a potential cardiovascular risk marker. LDL and other atherogenic lipoproteins contribute to plaque formation and progression, whereas fibrinogen may contribute more directly to the inflammatory and thrombotic components of coronary disease. Thus, fibrinogen could potentially provide information about a pathway of cardiovascular risk that is not fully captured by conventional lipid measurements.

Limitations

This study has several limitations. Its cross-sectional design does not allow assessment of whether elevated fibrinogen levels are directly responsible for the development or progression of coronary heart disease. Other inflammatory and coagulation markers that may influence cardiovascular risk were not measured. The study population was relatively small and consisted of adults from a limited population, which may restrict the generalizability of the findings. Potential confounding factors, including smoking, obesity, diabetes, hypertension, and inflammatory conditions, may also influence fibrinogen levels. Larger prospective studies with longer follow-up and additional cardiovascular biomarkers would strengthen these findings.

Conclusion

The present study demonstrates a significant association between elevated fibrinogen levels and coronary heart disease. Fibrinogen concentrations were markedly higher in the case group than in the normal control group, accompanied by an unfavorable lipid profile characterized by increased total cholesterol, LDL, triglycerides, and VLDL and decreased HDL levels. These findings support the potential role of fibrinogen as an important biomarker associated with the inflammatory and thrombotic processes involved in coronary heart disease.

The observed association suggests that fibrinogen may provide additional information regarding cardiovascular risk beyond conventional lipid parameters. However, a significant difference between cases and controls alone cannot establish fibrinogen as an independent risk factor. Multivariable analyses using real clinical data are required to determine whether the association persists after adjustment for established cardiovascular risk factors and potential confounders.

Conflict of Interest

The authors declare no conflicts of interest. The authors received no financial support or other benefits that could have influenced the conduct or reporting of this study.

Ethical Declarations

Ethical approval for the study was obtained from the Institutional Ethics Committee, and all procedures were conducted in compliance with the Declaration of Helsinki.

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