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INFLAMMATORY, LIPID, AND CARDIAC FUNCTION PROFILES IN PATIENTS WITH ACUTE MYOCARDIAL INFARCTION: A CASE–CONTROL STUDY FROM FERGANA

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ABSTRACT: This case–control study compared inflammatory, lipid, and cardiac function markers between 90 patients with acute myocardial infarction (MI) and 90 age- and sex-matched healthy controls at the Republican Specialized Scientific and Practical Medical Center of Cardiology, Fergana Branch. MI patients showed significantly higher high-sensitivity C-reactive protein (6.84 vs 1.92 mg/L), LDL cholesterol, fasting glucose, and lower HDL cholesterol and left ventricular ejection fraction (46.3% vs 62.1%; all $p<0.001$). These findings confirm that systemic inflammation, dyslipidemia, and impaired cardiac function characterise the acute MI phenotype in this regional population.

Keywords: myocardial infarction, inflammation, C-reactive protein, dyslipidemia, ejection fraction, case-control study

INTRODUCTION

Acute myocardial infarction (AMI) remains a principal cause of cardiovascular mortality worldwide and is increasingly prevalent in Central Asia, where modifiable risk factors are widely distributed. The pathophysiology of AMI extends beyond luminal stenosis to encompass systemic inflammation, endothelial dysfunction, and atherogenic dyslipidemia, which collectively drive plaque destabilisation and rupture (Libby, 2021).

High-sensitivity C-reactive protein (hs-CRP) has emerged as a validated biomarker of residual inflammatory risk, independently predicting recurrent ischaemic events even among patients achieving optimal lipid targets (Ridker, 2023). Concurrently, elevated low-density lipoprotein cholesterol (LDL-C) and reduced high-density lipoprotein cholesterol (HDL-C) sustain atherogenesis, while impaired left ventricular ejection fraction (LVEF) reflects the extent of ischaemic myocardial injury and prognosticates long-term outcomes (Bhatt et al., 2022).

Despite extensive international literature, comparative biomarker data from Uzbek clinical populations remain scarce. Characterising the inflammatory and metabolic profile of regional MI patients relative to healthy individuals is essential for risk stratification and culturally appropriate prevention strategies. The aim of this study was to compare inflammatory, lipid, and cardiac function markers between patients with acute MI and matched healthy controls in the Fergana region of Uzbekistan.

MATERIALS AND METHODS

Study Design and Setting. This case–control study was conducted at the Republican Specialized Scientific and Practical Medical Center of Cardiology, Fergana Regional Branch,

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between July 2023 and September 2025. The institutional administration approved the use of anonymised records.

Participants. Ninety consecutive patients with confirmed acute MI (STEMI or NSTEMI, diagnosed per the Fourth Universal Definition) constituted the case group. Ninety age- and sex-matched volunteers without cardiovascular disease, recruited during routine health screening, formed the healthy control group. Exclusion criteria included active infection, malignancy, autoimmune disease, or chronic kidney disease, all of which independently elevate inflammatory markers.

Measurements. Venous blood was sampled within 24 hours of admission for cases and during screening for controls. Assays included hs-CRP (immunoturbidimetry), a full lipid panel, and fasting glucose. LVEF was measured by transthoracic echocardiography using the biplane Simpson method. Demographic and comorbidity data were extracted from electronic records.

Statistical Analysis. Continuous variables are expressed as mean ± standard deviation (SD) and median with interquartile range (IQR); categorical variables as frequency and percentage. Between-group comparisons used the independent-samples t-test or Mann–Whitney U test for non-normally distributed variables, and the chi-square test for categorical data. Effect sizes (Cohen's d) were calculated for primary biomarkers. Statistical significance was set at $p<0.05$. Analyses were performed using SPSS v.25.

RESULTS

Baseline Characteristics. The groups were comparable in age (cases: 58.4 ± 10.2 years, median 59, IQR 51–66; controls: 56.9 ± 9.7 years, median 57, IQR 50–64; $p=0.31$) and sex distribution (male 67.8% vs 64.4%, $p=0.63$). However, MI patients had a significantly higher prevalence of cardiovascular risk factors, including diabetes mellitus (30.0% vs 10.0%), hypertension (80.0% vs 37.8%), current smoking (45.6% vs 20.0%), and higher body mass index (28.6 vs 26.3 kg/m²; all $p<0.001$) (Table 1).

Inflammatory Markers. hs-CRP was markedly elevated in MI patients (mean 6.84 ± 2.71 mg/L; median 6.40, IQR 4.8–8.6) compared with controls (mean 1.92 ± 0.83 mg/L; median 1.80, IQR 1.3–2.5; Mann–Whitney U, $p<0.001$). The corresponding effect size was large (Cohen's d = 2.46), indicating a robust inflammatory signature in the acute MI phenotype.

Lipid and Metabolic Profile. MI patients displayed significantly higher LDL-C (3.61 ± 0.92 vs 2.78 ± 0.66 mmol/L, $p<0.001$), lower HDL-C (1.02 ± 0.27 vs 1.38 ± 0.31 mmol/L, $p<0.001$), and higher fasting glucose (6.92 ± 2.14 vs 5.31 ± 0.94 mmol/L, $p<0.001$).

Cardiac Function. LVEF was substantially reduced in MI patients (46.3 ± 8.4%) relative to controls (62.1 ± 4.9%; $t = 15.4$, $p<0.001$; Cohen's d = 2.30), reflecting acute ischaemic myocardial impairment. Key comparisons are summarised in Table 1 and Figure 1.

Table 1.

Baseline, Inflammatory, Lipid, and Cardiac Characteristics (n = 180)

Parameter	MI Patients (n=90)	Healthy Controls (n=90)	p-value

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Age, mean ± SD (years)	58.4 ± 10.2	56.9 ± 9.7	0.31
Age, median (IQR)	59 (51–66)	57 (50–64)	—
Male sex, n (%)	61 (67.8)	58 (64.4)	0.63
Body mass index, kg/m²	28.6 ± 4.1	26.3 ± 3.5	**<0.001** *
Diabetes mellitus, n (%)	27 (30.0)	9 (10.0)	**<0.001** *
Hypertension, n (%)	72 (80.0)	34 (37.8)	**<0.001** *
Current smoking, n (%)	41 (45.6)	18 (20.0)	**<0.001** *
hs-CRP, mg/L (mean ± SD)	6.84 ± 2.71	1.92 ± 0.83	**<0.001** *
hs-CRP, median (IQR)	6.40 (4.8–8.6)	1.80 (1.3–2.5)	**<0.001** *
LDL cholesterol, mmol/L	3.61 ± 0.92	2.78 ± 0.66	**<0.001** *
HDL cholesterol, mmol/L	1.02 ± 0.27	1.38 ± 0.31	**<0.001** *
Fasting glucose, mmol/L	6.92 ± 2.14	5.31 ± 0.94	**<0.001** *
LVEF, % (mean ± SD)	46.3 ± 8.4	62.1 ± 4.9	**<0.001** *

*Note: * $p < 0.05$ (statistically significant). hs-CRP — high-sensitivity C-reactive protein; LDL — low-density lipoprotein; HDL — high-density lipoprotein; LVEF — left ventricular ejection fraction; IQR — interquartile range; SD — standard deviation.*

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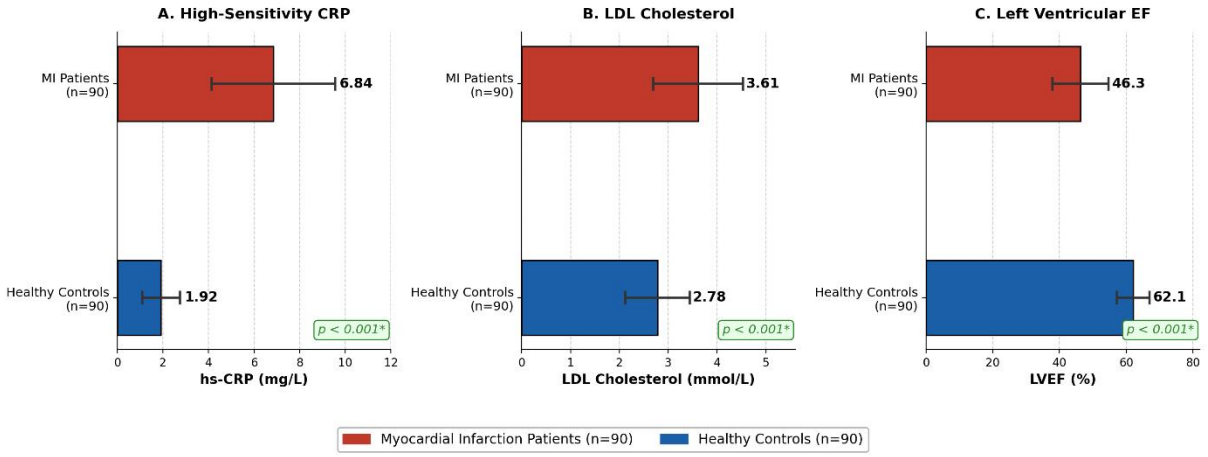


Figure 1. *Comparison of inflammatory (A — hs-CRP), lipid (B — LDL cholesterol), and cardiac function (C — LVEF) markers between MI patients and healthy controls. Bars show mean ± SD. *p < 0.001.*

DISCUSSION

This case–control study demonstrates that patients with acute MI in the Fergana region exhibit a distinct inflammatory and metabolic profile compared with healthy individuals. The most striking finding was the more than threefold elevation of hs-CRP among MI patients (6.84 vs 1.92 mg/L), consistent with the inflammatory hypothesis of atherothrombosis and with trials showing that residual inflammatory risk drives recurrent events independent of LDL lowering (Ridker, 2023; Libby, 2021).

The unfavourable lipid profile — higher LDL-C, lower HDL-C — alongside elevated fasting glucose underscores the central role of atherogenic dyslipidemia and dysglycaemia in this population. These results align with international evidence linking metabolic comorbidities to plaque vulnerability and worse post-infarction prognosis (Bhatt et al., 2022; Marston et al., 2022). The markedly reduced LVEF (46.3% vs 62.1%) confirms substantial ischaemic myocardial damage and identifies a subgroup at elevated risk of heart failure and arrhythmia.

The high prevalence of diabetes, hypertension, and smoking among cases reinforces the need for aggressive primary prevention in Uzbekistan. The strengths of this study include matched controls and a comprehensive biomarker panel; limitations include the single-centre design, modest sample size, and cross-sectional measurement, which precludes causal inference. Larger multicentre cohorts incorporating longitudinal follow-up are warranted to validate hs-CRP as a prognostic tool in the Central Asian context.

CONCLUSION

Patients with acute myocardial infarction in the Fergana region are characterised by significantly elevated systemic inflammation (hs-CRP), atherogenic dyslipidemia, dysglycaemia, and reduced left ventricular ejection fraction compared with healthy controls. These findings support the integration of inflammatory and metabolic biomarker assessment into routine risk stratification and emphasise the importance of intensified secondary prevention in this high-risk regional population.

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