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ORIGINAL ARTICLE

Glycemic Control, Lipid Profiles, and Cardiac Outcomes in Obese Patients with Ischemic Heart Disease. A Comparative Study

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ABSTRACT

Background: Obesity is a well-established risk factor for ischemic heart disease (IHD), exerting its effects through insulin resistance, dyslipidemia, and systemic inflammation. South Asian populations demonstrate a higher cardiometabolic burden, yet limited data exist on the interplay between glycemic control, lipid abnormalities, and cardiac outcomes in obese IHD patients.

Objective: To evaluate glycemic control, lipid profiles, and cardiac outcomes in obese patients with ischemic heart disease treated at two tertiary care hospitals in Pakistan.

Methodology: A comparative cross-sectional study was conducted on 100 obese patients with IHD at Nawaz Sharif Medical College, Aziz Bhatti Shaheed Teaching Hospital, Gujrat, and Chahudhary Pervaiz Elahi Institute of Cardiology, Wazirabad, from January to June 2023. Demographics, glycemic indices (fasting plasma glucose, HbA1c), lipid parameters (total cholesterol, triglycerides, LDL-C, HDL-C), inflammatory markers (hs-CRP), and cardiac biomarkers (NT-pro BNP, hs-troponin I) were measured. Echocardiographic outcomes included left ventricular ejection fraction (LVEF) and diastolic function. Statistical analyses were performed using t-tests, chi-square tests, and multivariate logistic regression.

Results: The cohort had a mean age of 56.8 ± 8.2 years with a male-to-female ratio of 1.2:1. Poor glycemic control was observed (HbA1c 7.9 ± 1.4%), with atherogenic dyslipidemia (TG 192.4 ± 46.8 mg/dL, LDL-C 136.7 ± 32.1 mg/dL, HDL-C 38.6 ± 8.2 mg/dL). Elevated hs-CRP, NT-pro BNP, and hs-troponin I were significantly associated with reduced LVEF (<45%) and diastolic dysfunction. Nearly one-third experienced acute coronary syndromes during the study period.

Conclusion: Obese IHD patients exhibit poor metabolic and inflammatory profiles strongly linked to adverse cardiac outcomes. Comprehensive strategies targeting glycemic control, lipid optimization, and early biomarker-based risk assessment are essential for improving prognosis in this high-risk population.

Keywords: Obesity, ischemic heart disease, glycemic control, lipid profile, cardiac biomarkers, South Asia.

INTRODUCTION

Cardiovascular disease (CVD), particularly ischemic heart disease (IHD), remains the leading cause of mortality globally, with obesity being a major modifiable risk factor. [1] Obesity contributes to insulin resistance, dyslipidemia, hypertension, and systemic inflammation, all of which accelerate atherogenesis and worsen outcomes in IHD. [2,3] Effective glycemic control and optimal lipid profiles are pivotal in reducing cardiovascular events in this high-risk population.[4]

Obesity is closely linked to disturbances in lipid metabolism, often manifesting as elevated triglycerides (TG), increased low-density lipoprotein cholesterol (LDL-C), and reduced high-density lipoprotein cholesterol (HDL-C).[5] In individuals with type 2 diabetes mellitus (T2DM), elevated blood glucose levels are positively correlated with adverse lipid profiles including higher TG, LDL-C, and unfavorable lipid ratios thus compounding cardiovascular risk.[6] Compelling evidence also points to the power of dietary and pharmacologic interventions in improving both glycemic control and lipid parameters among obese individuals.[7]

Glycemic dysregulation further exacerbates cardiovascular risk. Elevated glucose levels impair endothelial function through oxidative stress and inflammation, contributing to coronary microvascular dysfunction and myocardial ischemia even in the absence of obstructive coronary disease.[8] Women, in particular, exhibit a unique cardiometabolic risk profile where obesity and diabetes intersect to heighten the incidence and severity of IHD.[9] Metabolic indices such as the triglyceride-glucose (TyG) index and lipid accumulation product (LAP) have emerged as stronger predictors of cardiovascular events compared to traditional glucose or lipid metrics alone.[10]

Despite these insights, there remains a paucity of data specifically exploring how glycemic control and lipid profiles interrelate with cardiac outcomes in obese IHD patients, particularly in South Asian populations. This study aims to fill that gap by comparing glycemic control, lipid metrics, and cardiac outcomes in obese patients with IHD treated at Nawaz Sharif Medical College Teaching Hospital and Chahudhary Pervaiz Elahi Institute of Cardiology between January and June 2023.

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MATERIALS AND METHODS

This comparative cross-sectional study was conducted at Nawaz Sharif Medical College, Aziz Bhatti Shaheed Teaching Hospital, Gujrat, and Chahudhary Pervaiz Elahi Institute of Cardiology, Wazirabad, between January 2023 and June 2023. A total of 100 obese patients with ischemic heart disease were enrolled using non-probability purposive sampling. Obesity was defined according to Asian-specific BMI criteria (≥27 kg/m²). All patients were diagnosed with ischemic heart disease based on clinical evaluation, electrocardiography, and echocardiographic findings. Patients with chronic kidney disease, chronic liver disease, thyroid dysfunction, or malignancy were excluded to avoid confounding effects on biochemical parameters.

Demographic data including age, sex, body mass index (BMI), duration of ischemic heart disease, smoking status, hypertension, and family history of cardiovascular disease were recorded through structured proformas and medical records. Clinical characteristics were further stratified by gender to assess sex-specific variations in risk factors and outcomes. Biochemical parameters were obtained after an overnight fast of at least 10–12 hours. Venous blood samples were collected under aseptic conditions and analyzed in hospital laboratories using standardized enzymatic and immunoassay techniques. Fasting plasma glucose (FPG) and glycated hemoglobin (HbA1c) were measured as indices of glycemic control. Lipid profiles included total cholesterol, triglycerides (TG), low-density lipoprotein cholesterol (LDL-C), and high-density lipoprotein cholesterol (HDL-C). Cardiac biomarkers including high-sensitivity troponin I (hs-TnI) and N-terminal pro–B-type natriuretic peptide (NT-proBNP) were measured to assess

myocardial injury and ventricular stress. Additional inflammatory markers such as high-sensitivity C-reactive protein (hs-CRP) were recorded where available.

Cardiac outcomes were determined by echocardiographic assessment of left ventricular ejection fraction (LVEF), presence of diastolic dysfunction, and history of recent acute coronary syndrome (ACS) during the study period. Data on hospitalization, recurrent angina, and revascularization procedures were also documented. Statistical analysis was performed using SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. Independent sample t-tests or Mann–Whitney U tests were applied for comparison of continuous variables between groups depending on data distribution. Categorical variables were analyzed using chi-square tests. Associations between glycemic control, lipid parameters, and cardiac outcomes were assessed using multivariate logistic regression models adjusted for age, sex, BMI, hypertension, and smoking status. Pearson or Spearman correlation coefficients were applied to evaluate linear associations between biomarkers. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 100 obese patients with ischemic heart disease were included in the study, with 55 males and 45 females. The mean age of the cohort was 56.8 ± 8.2 years, ranging from 42 to 72 years. The mean body mass index (BMI) was 30.7 ± 2.6 kg/m². A positive family history of cardiovascular disease was present in 38% of patients, and 41% were current smokers. Hypertension was documented in 62% of participants, while 44% were known diabetics prior to enrollment. Baseline demographic characteristics are summarized in Table 1.

Table 1: Baseline demographic and clinical characteristics of study population (n = 100)

Variable	Total (n=100)	Male (n=55)	Female (n=45)	p-value
Age (years), mean ± SD	56.8 ± 8.2	57.4 ± 8.0	56.1 ± 8.4	0.512
BMI (kg/m²), mean ± SD	30.7 ± 2.6	30.5 ± 2.5	31.0 ± 2.8	0.376
Hypertension (%)	62	33 (60.0)	29 (64.4)	0.663
Diabetes mellitus (%)	44	22 (40.0)	22 (48.9)	0.384
Smoking history (%)	41	28 (50.9)	13 (28.9)	0.031*
Family history of CVD (%)	38	20 (36.4)	18 (40.0)	0.719

*Significant at p < 0.05

Table 2: Glycemic and lipid profile parameters in study population

Parameter	Mean ± SD	Reference Range
Fasting plasma glucose (mg/dL)	148.6 ± 36.2	<100
HbA1c (%)	7.9 ± 1.4	<5.7
Total cholesterol (mg/dL)	212.5 ± 38.6	<200
Triglycerides (mg/dL)	192.4 ± 46.8	<150
LDL-C (mg/dL)	136.7 ± 32.1	<100
HDL-C (mg/dL)	38.6 ± 8.2	>40 (men), >50 (women)
hs-CRP (mg/L)	4.8 ± 1.9	<3

*Significant at p < 0.05

Biochemical analyses revealed a mean fasting plasma glucose of 148.6 ± 36.2 mg/dL and a mean HbA1c of 7.9 ± 1.4%, indicating suboptimal glycemic control in a large proportion of patients. Lipid profile assessment demonstrated mean total cholesterol of 212.5 ± 38.6 mg/dL, triglycerides of 192.4 ± 46.8 mg/dL, LDL-C of 136.7 ± 32.1 mg/dL, and HDL-C of 38.6 ± 8.2 mg/dL. These values reflected a predominance of dyslipidemia, especially hypertriglyceridemia and low HDL-C, consistent with obesity-associated metabolic disturbances. Table 2 presents the biochemical parameters in detail.

Evaluation of cardiac outcomes showed that 29% of patients presented with a recent acute coronary syndrome (ACS) within the study period, and 35% had a history of prior revascularization either by percutaneous coronary intervention or coronary artery bypass grafting. Echocardiographic assessment revealed that the mean left ventricular ejection fraction (LVEF) was 47.2 ± 9.5%, with 41% of patients having an LVEF <45%. Diastolic dysfunction was observed in 58% of participants. Levels of NT-pro BNP and hs-troponin I were significantly higher among patients with reduced LVEF, suggesting strong associations between biochemical derangements and adverse cardiac outcomes. These findings are summarized in Table 3.

Table 3: Cardiac outcomes and biomarkers in obese IHD patients

Outcome/Marker	Total (n=100)	Male (n=55)	Female (n=45)	p-value
Recent ACS (%)	29	15 (27.3)	14 (31.1)	0.685
Prior revascularization (%)	35	21 (38.2)	14 (31.1)	0.472
LVEF (%) mean ± SD	47.2 ± 9.5	48.0 ± 9.2	46.3 ± 9.9	0.428
LVEF <45% (%)	41	20 (36.4)	21 (46.7)	0.303
Diastolic dysfunction (%)	58	30 (54.5)	28 (62.2)	0.448
NT-pro BNP (pg/mL), mean ± SD	568 ± 192	551 ± 184	587 ± 201	0.421
hs-Troponin I (ng/L), mean ± SD	0.134 ± 0.06	0.128 ± 0.05	0.141 ± 0.07	0.289

*Significant at p < 0.05

In summary, the study demonstrated that obese patients with ischemic heart disease exhibited poor glycemic control with elevated fasting glucose and HbA1c values, along with atherogenic lipid profiles characterized by high triglycerides, elevated LDL-C, and reduced HDL-C. Inflammatory and cardiac biomarkers, including hs-CRP, NT-pro BNP, and hs-troponin I, were also elevated in a significant proportion of patients. Echocardiographic assessment revealed a high prevalence of reduced left ventricular ejection fraction and diastolic dysfunction, while nearly one-third experienced recent acute coronary syndromes and over one-third had undergone prior revascularization. These findings collectively indicate that metabolic dysregulation in obese individuals with IHD is strongly linked to adverse cardiac outcomes. Overall, the study demonstrated that poor glycemic control, elevated triglycerides, low HDL-C, and elevated inflammatory and cardiac biomarkers were strongly associated with reduced ejection fraction, higher prevalence of diastolic dysfunction, and increased frequency of acute coronary events among obese patients with ischemic heart disease.

DISCUSSION

In this study of obese patients with ischemic heart disease (IHD), our key findings namely poor glycemic control, atherogenic lipid profiles (elevated triglycerides and LDL-C, with reduced HDL-C), heightened inflammatory and cardiac biomarkers, and impaired echocardiographic outcomes are consistent with the increasing body of literature linking obesity-driven metabolic disturbances to adverse cardiovascular events. First, the coexistence of obesity, dyslipidemia, and IHD has been well-documented [11]. Obesity

independently predisposes individuals to cardiovascular disease through mechanisms that include insulin resistance, systemic inflammation, hypertension, and dyslipidemia[18]. In particular, dyslipidemia characterized by elevated LDL-C and triglycerides, with lower HDL-C, accelerates atherogenesis in obese patients [20]. These metabolic derangements likely underlie our observed associations between lipid abnormalities and reduced left ventricular ejection fraction (LVEF) as well as diastolic dysfunction [15].

Second, our results align with evidence that improving weight status even modestly can favorably modify lipid profiles. Modest, non-interventional weight changes have been shown to significantly affect the triglyceride to HDL-C ratio (TG/HDL-C), a surrogate for insulin resistance and cardiovascular risk [16]. This supports the notion that even slight improvements in BMI can yield metabolic benefits, potentially ameliorating cardiac outcomes in obese IHD patients. Third, emerging novel biomarkers of vascular risk have been investigated in obese populations. In particular, studies focusing on obese children and young adults have explored markers such as fetuin-A, E-selectin, and osteoprotegerin showing elevated levels in obese and diabetic individuals compared to controls, and correlating with cardiovascular risk markers like carotid intima-media thickness[19]. Although our study did not measure these specific biomarkers, our findings of elevated hs-CRP, NT-pro BNP, and hs-troponin I reinforce the critical role of a pro-inflammatory and myocardial stress milieu in obese IHD patients [17].

Fourth, in the context of South Asian populations, genetic predispositions amplify the impact of obesity-mediated metabolic abnormalities. Apolipoprotein E (ApoE) polymorphisms in Pakistani subjects have been linked to variations in lipid levels and cardiovascular complications among diabetics, suggesting that genetic factors may modulate the severity of dyslipidemia and IHD risk in our demographic [12]. These findings underscore the importance of considering both metabolic and genetic determinants of cardiac outcomes in our region. Taken together, our findings underscore the devastating triad of poor glycemic control, dyslipidemia, and inflammatory activation in driving cardiac dysfunction and events among obese IHD patients. They reinforce the need for aggressive multifaceted interventions including dietary modification, weight reduction, optimized glycemic targets, lipid-lowering strategies, and perhaps, where feasible, biomarker-guided risk stratification in this high-risk population [16].

CONCLUSION

This study demonstrated that obese patients with ischemic heart disease have significantly impaired glycemic control, dyslipidemia, elevated inflammatory and cardiac biomarkers, and compromised echocardiographic outcomes. The strong association between poor metabolic status and adverse cardiac events highlights the urgent need for aggressive risk factor modification, including optimized glycemic and lipid management, lifestyle interventions, and early biomarker-guided risk stratification. Addressing these interlinked factors may improve long-term cardiovascular outcomes in this high-risk population, particularly within South Asian settings where obesity and ischemic heart disease are rapidly increasing.

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Research Interest: The authors' primary research interests lie in cardiovascular epidemiology, obesity-related metabolic disturbances, glycemic control, and preventive cardiology, with a particular focus on the South Asian population. Their work emphasizes the clinical significance of biochemical and inflammatory biomarkers in predicting adverse cardiac outcomes and guiding therapeutic interventions.

Authors' Contribution: M.Z.A.R. conceptualized the study, supervised the research process, and prepared the initial draft of the manuscript. A.S. and S.A.Z. contributed to patient recruitment, data collection, and critical review of the manuscript. T.M. performed echocardiographic evaluations and contributed to the interpretation of cardiac outcomes. A.A.C. assisted with biochemical analysis and data entry. F.A. coordinated patient follow-up and managed data quality assurance. All authors reviewed the final version of the manuscript, approved its submission, and agreed to be accountable for the integrity and accuracy of the work.

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