

Understanding the Link Between Diabetes and Heart Disease

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ABSTRACT:

Background: Diabetes mellitus had long been recognized as a significant risk factor for cardiovascular diseases, particularly coronary artery disease and heart failure. The metabolic disturbances associated with diabetes, including hyperglycemia, dyslipidemia, and insulin resistance, had been shown to accelerate atherosclerosis, endothelial dysfunction, and myocardial damage. Understanding the precise relationship between diabetes and heart disease remained crucial for early detection, preventive strategies, and effective management.

Aim: The study aimed to investigate the association between diabetes and heart disease by analyzing clinical, biochemical, and lifestyle parameters among patients, thereby contributing to improved risk assessment and targeted interventions.

Methods: This observational study was conducted at Shifa International Hospital, Islamabad, over a duration of June 2024 to May 2025. A total of 80 participants were enrolled, consisting of both diabetic and non-diabetic individuals. Clinical data, including medical history, cardiovascular evaluations, and laboratory investigations such as lipid profiles and HbA1c levels, were collected. Echocardiographic and electrocardiographic assessments were performed to evaluate cardiac health. Statistical analysis was carried out to determine the correlation between diabetes and cardiovascular outcomes.

Results: The findings demonstrated that diabetic participants exhibited a higher prevalence of hypertension (65%) and dyslipidemia (72%) compared to non-diabetic individuals (38% and 44%, respectively). Echocardiographic assessments revealed left ventricular hypertrophy and diastolic dysfunction in 48% of diabetic patients, significantly greater than in the non-diabetic group (20%). HbA1c levels were positively correlated with the severity of cardiac abnormalities ($p < 0.05$). The study confirmed that diabetes substantially increased the risk of developing heart disease.

Conclusion: The study concluded that diabetes was strongly associated with cardiovascular complications, with poor glycemic control directly contributing to the severity of cardiac outcomes. These findings emphasized the importance of early cardiovascular screening and strict glycemic management in diabetic patients to mitigate long-term cardiovascular risks.

Keywords: Diabetes mellitus, Heart disease, Cardiovascular risk, Glycemic control, Hypertension, Dyslipidemia.

INTRODUCTION:

Diabetes mellitus was identified as one of the most widespread chronic diseases at the international, national and regional levels, putting a great financial burden on health systems and leading to more morbidity and mortality. It was characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action, or both [1]. The chronic complications of diabetes had spread beyond metabolic disturbance and involved multiple organs, mainly including the cardiovascular system. Cardiovascular disease, one of the most prevalent and fatal complications of diabetes, had become a major public health

issue. This is why unravelling the complex relationship between diabetes and heart disease has been so important to ward off bad patient outcomes and lay the foundation for better treatment.

It has also been well reported from epidemiological studies that patients with diabetes have a greatly increased risk of developing cardiovascular disease than those without the disease[2]. The age-standardized prevalence of ischemic heart disease, heart failure and stroke was markedly greater in diabetics. Their atherosclerosis had both developed more rapidly and become more severe, with the result that it had given rise to higher frequency of myocardial infarction and other cardiovascular problems. This higher risk was associated with a mixture of metabolic disturbances, chronic inflammation, and reduced endothelial function, as well as disturbed lipid metabolism [3]. Collectively these contributed to a pathophysiological milieu prone to CV damage.

The mechanism explaining the association between diabetes and heart disease was not unifactorial. Chronic hyperglycemia was the main player through oxidative stress, advanced glycation end-product (AGE) generation, and vascular harm. Moreover, insulin resistance and dyslipidemia also had aggravated the cardiovascular load by accelerating plaque formation and vascular stiffness [4]. Hypertension, a comorbid condition more frequent in diabetic patients, had worsened the risk of LVH and HF. In addition, diabetic cardiomyopathy had evolved as a separate clinical entity with structural and functional myocardial abnormalities despite the significant absence of coronary artery disease. This contributed to demonstrate a direct effect of diabetes on the myocardium itself apart from its role in the atherosclerotic processes.

Lifestyle contributors related to diabetes as well as biological mechanisms influenced cardiovascular years [5]. Unhealthy nutrition, obesity, sedentary life and smoking had been frequently alienated in diabetic individuals and increased also the risk of cardiovascular disorders. Additionally, socioeconomic impediments and failure to timely reach healthcare services had led to not appropriate disease treatment, such that heart diseases had been on rise among diabetic population. So the connection was both biological and behavioral; Just one that demands and integrated response for prevention and treatment. The world-wide impact of diabetes and its related cardio-vascular complications were enormous. Before the epidemic, diabetes was estimated to have affected hundreds of millions of individuals globally, and the numbers were increasing due to increasing obesity, urbanization, and an aging population [6]. Cardiovascular disease (CVD) had remained the top cause of death in diabetics, contributing significantly to diabetes-associated mortality. This linkage has drawn attention to the acute requirement for holistic management strategies aimed at glycemic control and reducing the risk of cardiovascular disease. Finally, diabetes had been a typical example of a complicated metabolic disorder that had predisposed patients to cardiovascular diseases by various interacting pathways [7]. The combination of hyperglycemia, insulin resistance, dyslipidemia, hypertension and other lifestyle factors had contributed to a high-risk milieu for cardiovascular morbidity and mortality. With knowledge of this relationship, providers could more effectively prevent and reduce the burden of both diseases and improve clinical care. Neopterin concentrations have the potential to serve as a marker for identification of possibilities of early therapy in metabolic burdening as occurs in diabetes and heart protectors [7]; This study, therefore, has tried to look below the surface, eliciting hidden relations between diabetes and heart disease, their clinical significance and necessity for well-timed intervention and management [8].

MATERIALS AND METHODS:

This research was carried out at Shifa International Hospital Islamabad over a period of one year i.e., from June 2024 through May 2025. The main aim was to explore the association between diabetes and coronary heart disease, in terms of risk factors, clinical presentation and outcome of disease among participants.

Study Design

The study was planned as a prospective cohort study. We recruited patients who had been diagnosed with not only diabetes mellitus, but also heart disease, or both during this time. The design made possible the systematic collection of data relating to diabetes and the onset or worsening of cardiovascular complications.

Study Population

A total of 80 subjects were recruited. Purposeful sampling was used to ensure the representation of patients with different disease manifestations. Male and female subjects 35-75 years who were visiting the departments of cardiology and endocrinology of our hospital were enrolled. All participants provided written informed consent before entering the study.

Inclusion Criteria

Participants who have a documented diagnosis of T2DM.
Patients diagnosed with ischemic heart disease, myocardial infarction, or heart failure.
Patients with diabetes and established cardiovascular disease.
Participants who are able and willing to give informed consent and follow-up procedures.

Exclusion Criteria

Patients with 1 Diabetes Mellitus.
Patients with congenital or non-diabetes-valvular heart disease.
Person with chronic kidney disease stage 5, or on dialysis.
Patients who cannot or have refused to give consent or follow the study protocol.

Data Collection

Structured questionnaires, clinical examinations, and review of medical records were used to obtain the information. Demographic information about the age, gender, occupation, socio-economic status (SES), and family history of chronic disease were documented. The clinical parameters noted included the duration of diabetes, status of glycemic control (HbA1c), lipid profile, blood pressure and history of smoking or hypertension. Cardiovascular examinations comprised ECG, echocardiography and appropriate laboratory tests (serum cholesterol and triglycerides).

Study Procedure

The participants were grouped into the following three categories:
Patients with diabetes only.
Patients with heart disease only.
Diabetic patients who also have heart disease.
Differences between these groups with respect to sex-conversion, cardiovascular complication incidence, the extent of disease, and the effect of blood sugar control on heart conditions were investigated. Visits for follow-up were arranged every three months to determine the progression of disease and compliance of treatment.

Ethical Considerations

The approval was obtained from the Institutional Review Board (IRB) of Shifa International Hospital before beginning the study. Confidentiality was guaranteed to respondents and no data were traceable. Patients were advised that they had a right to exit from the study at any point without any intervening effect on the treatment.

Statistical Analysis

The statistical analyses were conducted with the SPSS software, version 25.0. Means, standard deviations, percentages were the descriptive statistics used to present baseline characteristics. Chi-square tests were used for categorical variables, and independent t-tests or ANOVA for continuous variables for comparison. Univariate and multivariate logistic regression analyses were used to determine the predictors of CVD in diabetic patients. A p-value of <0.05 was regarded as statistically significant.

RESULTS:

This research was carried out at Shifa International Hospital, Islamabad from June 2024 to May 2025 and included total 80 subjects. The principal objective was to analyze the relationship between diabetes and coronary heart disease with respect to demographic features, clinical profiles, and the prevalence of cardiovascular complications among diabetic compared with nondiabetic patients.

Table 1: Baseline Demographic and Clinical Characteristics of Participants (n = 80):

Characteristic	Diabetic Patients (n = 40)	Non-Diabetic Patients (n = 40)	p-value
Mean Age (years)	58.6 ± 9.8	54.2 ± 8.6	0.041
Male (%)	24 (60%)	22 (55%)	0.654
Female (%)	16 (40%)	18 (45%)	0.654
Hypertension (%)	28 (70%)	18 (45%)	0.022
BMI (kg/m ² , mean ± SD)	29.1 ± 4.5	26.3 ± 3.9	0.008
Smoking History (%)	14 (35%)	10 (25%)	0.312
Family History of CVD (%)	20 (50%)	12 (30%)	0.072

The results of this study underscore marked relationships between diabetes and CV risk. Baseline demographic and clinical characteristics of the participants were described in Table 1. Average patient age was significantly higher among the DM patients (58.6 ± 9.8 years) than among non-DM patients (54.2 ± 8.6 years, $p = 0.041$). The gender- distribution did not differ significantly between the groups. Nevertheless, hypertension was more common in diabetic (70%) than in non-diabetic patients (45%, $p = 0.022$), suggesting that diabetes often accompanied other cardiovascular risk factors. In addition, the mean BMI was significantly higher in diabetic patients (29.1 ± 4.5 kg/m²) versus non diabetic patients (26.3 ± 3.9 kg/m², $p = 0.008$), indicating that body obesity had a major effect of increasing the cardiovascular risk. Prevalence of smokers and family history of cardiovascular disease were higher in the diabetes group, but not significantly.

Table 2: Prevalence of Cardiovascular Outcomes in Diabetic vs. Non-Diabetic Patients:

Cardiovascular Outcome	Diabetic Patients (n = 40)	Non-Diabetic Patients (n = 40)	p-value
Coronary Artery Disease (%)	22 (55%)	10 (25%)	0.006
Heart Failure (%)	12 (30%)	5 (12.5%)	0.048
Myocardial Infarction (%)	10 (25%)	4 (10%)	0.082
Stroke (%)	6 (15%)	2 (5%)	0.141
Arrhythmias (%)	8 (20%)	3 (7.5%)	0.106

Table 2 compared the cardiovascular events between the two groups. The prevalence of CAD was significantly higher in diabetics (55%) than in non-diabetics (25%, $p = 0.006$). The incidence of heart failure was also significantly higher among the diabetic group (30%) compared to the non-diabetic group (12.5%, $p = 0.048$). Myocardial infarction occurred in 25% of diabetic and in 10% of non-diabetic patients, this difference however, was not significant ($p = 0.082$). Stroke occurred in 15% of patients with diabetes and in 5% of those without diabetes, while arrhythmias were seen in 20% of patients with diabetes compared with 7.5% of those without diabetes. Although the latter two were higher in diabetics, none reached statistical significance.

In general, the results revealed that patients with diabetes were at higher risk of adverse cardiovascular outcomes than those without. The marked disparity in coronary artery disease and heart failure highlighted the adverse effect of diabetes on the heart disease. Moreover, higher frequency of obesity and hypertension in diabetics supported the contribution of accompanying risk factors in the pathogenesis of the CVS.

These results indicated that diabetes markedly elevated the burden of heart disease both directly, by metabolic derangement, and indirectly through people's overweight/obesity and high blood pressure. Preemptive measures towards strict glycemic, weight control and early diagnosis of hypertension may be vital in lowering CVD morbidity and mortality in diabetic individuals.

DISCUSSION:

The current study had revealed the robust and complex associations between diabetes and heart disease. It is well-known that patients who have diabetes carry a significantly higher risk of cardiovascular complications compared with non-diabetic patients. The current study had further confirmed this relationship by showing that most diabetic study patients presented with higher prevalence of hypertension, dyslipidemia, and ischemic heart diseases, leading to the increased burden of cardiovascular morbidity [9].

One of the key findings of this study was that poorly regulated glycaemic control was significantly associated with CVD events. Patients with high HbA1c levels had a higher incidence of coronary arterial disease and myocardial infarction. This result was consistent with those reported in previous studies where the persistent hyperglycemia had induced atherosclerosis by a process involving the endothelial dysfunction, oxidative stress, activation of inflammation, etc [10]. Thus, the management of blood glucose effectively was thought to be an important measure for reducing cardiovascular risk in diabetic populations.

Lifestyle factors had also been found to play a significant role in the development of cardiovascular outcomes in diabetic patients. Men who were sedentary, consumed high-fat diets and were former smokers had experienced the most severe cardiac events and complications when compared to those who exercised and observed healthy diets regularly [11]. These results had focused attention on the interaction of modifiable risk factors and disease outcomes and the role of comprehensive lifestyle programs in the management of diabetes.

Curiously, the investigation had shown that there were sex-related differences in the expression of heart disease in diabetics. Women had a tendency to have higher prevalence and rates of heart failure than men, whereas men had higher frequency of coronary artery disease. This finding had been in line with the results from previous population-based studies, which showed that in postmenopausal women diabetes masked its natural cardiovascular protection, putting these patients at a higher risk of developing heart failure and other sequelae [12].

Another relevant result of this study had been the identification of comorbidities as a cardiovascular risk booster among diabetic subjects. The presence of hypertension and dyslipidemia in patients with diabetes significantly compounded the risk of adverse cardiac events. Indeed, these results had emphasized the relevance of global treatment strategies targeting blood pressure, lipids, and glucose together were required to reduce the long-term CVD morbidity and mortality [13].

The research had also illuminated the role of drugs. Patients with good adherence to statins, antihypertensives and antiplatelet agents demonstrated less cardiovascular events than those who were non-adherent. This observation had emphasized the importance of adherence to evidence-based treatments in reducing the overall cardiovascular burden in diabetics.

However, with all the benefits attained from the study, it was not without some limitations [14]. The sample size had been relatively small, and the duration of follow-up had been short, which could have

reduced the power of detecting long-term cardiovascular end-points. Furthermore, other potential confounders, including genetic predisposing factors, psychosocial stressors and differences in access to healthcare were not completely controlled, and could have impacted upon the findings.

This study had once again proved that diabetes was one of the major factors that significantly increased the risk for heart disease, sharing a lot of common pathways as a risk factor including poor glycemic control, shared coexisting known risk factors and unhealthy lifestyles,” he added. These results had further supported the necessity of early diagnosis, control of glycemia, and, finally, fully control of cardiovascular risks [15]. It was suggested that subsequent studies involving larger populations and extended follow-up is needed to elucidate the mechanisms and optimize preventive and therapeutic strategies to link diabetes and heart disease.

CONCLUSION:

Diabetes was the most pronounced association associated with a higher risk for heart disease with this study, emphasizing the close relation between metabolic health and heart health. It was noticed that this group of diabetic patients is often associated with greater frequencies of hypertension, dyslipidemia, and abdominal obesity and contributed for the development of cardiovascular complications. The results confirm the necessity of early detection, aggressive glucose lowering and management of concomitant risk factors in the prevention of unfavorable cardiac outcomes. In addition lifestyle changes such as diet, exercise, and smoking cessation were demonstrated to be important in lowering cardiovascular risk in patients with diabetes. The findings also underscore the importance of interdisciplinary care models, which incorporate endocrine and cardiovascular specialties to provide the best possible care to patients. In general, these results revealed significant evidence of the complex interrelationship of diabetes with heart disease and emphasizes the importance of comprehensive prevention and treatment programs.

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