



IJPPR

INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
An official Publication of Human Journals

ISSN 2349-7203




Human Journals

Research Article


February 2024 Vol.:30, Issue:2

© All rights are reserved by Zeeshan Akbar et al.

Impact of Diabetes on Cardiovascular Outcomes: A Meta-Analysis Assessing the Influence of Diabetes on the Risk of Cardiovascular Events and Mortality in Patients with Coronary Artery Disease



IJPPR
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
An official Publication of Human Journals



ISSN 2349-7203

Zeeshan Akbar*¹, Mahrukh Naeem*², Ammara Tahir³, Ibrahim Khalid Chaughtai⁴, Usman Mateen⁵, Muhammad Usman Nazir⁶, Muhammad Naveed Ahmed⁷, Rabia Iftikhar⁷, Fiza Anwer⁸

1. Azra Naheed Medical College, Pakistan.
2. Gujranwala Teaching Hospital, Gujranwala, Pakistan.
3. DHQ, Gujranwala, Pakistan.
4. Fatima Memorial Hospital, Lahore, Pakistan.
5. Niazi Hospital, Lahore, Pakistan.
6. Lahore General Hospital, Lahore, Pakistan.
7. Ministry of Health, Riyadh, KSA
8. Services Institute of Medical Sciences, Lahore, Pakistan.

Submitted: 25 January 2024
Accepted: 31 January 2024
Published: 29 February 2024

Keywords: Diabetes, Cardiovascular Outcomes

ABSTRACT

Introduction: Diabetes mellitus, a chronic metabolic disorder characterized by elevated blood glucose levels, has emerged as a global health challenge of staggering proportions. **Objectives:** The basic aim of the study is to find the impact of diabetes on cardiovascular outcomes for assessing the influence of diabetes on the risk of cardiovascular events and mortality in patients with coronary artery disease. **Materials and Methods:** This retrospective cohort study aimed to investigate the impact of diabetes on cardiovascular outcomes in a cohort of 1250 patients. The study was conducted at Azra Naheed Medical College and Gujranwala Teaching Hospital, Gujranwala, from 2021 to 2022. Medical records of patients were systematically reviewed to identify individuals who met the inclusion criteria. Patients aged 18 to 60 years, with a confirmed diagnosis of diabetes based on diagnostic criteria, were included. **Results:** Out of the initial pool of 1250 patients screened, 950 were identified as meeting the inclusion criteria for this study. The mean age of the diabetic cohort was 55.8 ± 8.2 years. Among these individuals, 55.6% were male and 44.4% were female. The average duration of diabetes was 9.3 ± 4.1 years, ranging from 3 to 20 years. The mean HbA1c level at baseline was $7.9\% \pm 1.2\%$, indicative of fair glycemic control. Analysis of cardiovascular risk factors revealed that 78.3% of the diabetic cohort had hypertension, with an average systolic blood pressure of 132.5 ± 12.3 mmHg and diastolic blood pressure of 81.2 ± 8.7 mmHg. **Conclusion:** The study's results demonstrate that individuals with diabetes face a heightened risk of major cardiovascular events, including myocardial infarctions, strokes, and cardiovascular-related deaths. This risk is further compounded by the development of micro vascular complications such as diabetic retinopathy and nephropathy, which underline the systemic nature of diabetes-related pathophysiology.



ijppr.humanjournals.com

INTRODUCTION

Diabetes mellitus, a chronic metabolic disorder characterized by elevated blood glucose levels, has emerged as a global health challenge of staggering proportions. With an estimated 463 million adults affected worldwide as of 2019, diabetes presents a significant burden on healthcare systems and societies at large. Beyond its immediate metabolic implications, diabetes is intricately linked to a plethora of long-term complications that encompass almost every organ system in the body. Among these complications, cardiovascular disease stands out as a leading cause of morbidity and mortality among individuals with diabetes [1].

The relationship between diabetes and cardiovascular disease is multifaceted, involving complex mechanisms that intertwine metabolic dysregulation, inflammation, oxidative stress, and endothelial dysfunction. Over the past decades, extensive research has elucidated the intricate pathways through which diabetes accelerates the atherosclerotic process and promotes adverse cardiovascular outcomes [2].

The impact of diabetes on the cardiovascular system is not limited to a single manifestation; rather, it encompasses a spectrum of disorders ranging from coronary artery disease and myocardial infarction to heart failure, stroke, and peripheral vascular disease [3].

Understanding the profound interplay between diabetes and cardiovascular outcomes is crucial for healthcare professionals, researchers, and policymakers alike. This knowledge holds the key to implementing effective prevention strategies, devising targeted treatment approaches, and ultimately mitigating the substantial human and economic toll of diabetes-associated cardiovascular complications. As new insights continue to emerge from ongoing studies and clinical trials, it is imperative to keep pace with the evolving landscape of research and practice to better inform clinical decision-making and improve patient outcomes [4].

In this review, we delve into the intricate mechanisms underpinning the impact of diabetes on cardiovascular outcomes. We explore the epidemiological landscape, dissect the molecular and cellular pathways involved, and examine the clinical implications of these interactions. By synthesizing the existing body of knowledge, we aim to shed light on the complex relationship between diabetes and cardiovascular disease, paving the way for a more comprehensive understanding and effective management of this critical healthcare challenge. In recent years, the surge in diabetes prevalence has mirrored the global rise in obesity and

sedentary lifestyles, highlighting the influence of modifiable risk factors on disease development [5].

Type 2 diabetes, in particular, often referred to as adult-onset diabetes, and has gained notoriety for its close association with lifestyle choices, including poor dietary habits and physical inactivity. This link underscores the potential for preventive interventions, emphasizing the importance of public health campaigns that promote healthy living to curb the diabetes epidemic and its downstream cardiovascular complications. While both type 1 and type 2 diabetes confer an increased risk of cardiovascular disease, the mechanisms driving this risk may differ. Type 1 diabetes arises from the autoimmune destruction of insulin-producing pancreatic beta cells, leading to an absolute insulin deficiency [6].

In contrast, type 2 diabetes typically involves a combination of insulin resistance and relative insulin deficiency, with obesity and genetic factors playing significant roles. These distinct pathophysiological underpinnings may translate into varying patterns of cardiovascular involvement, necessitating tailored approaches to risk assessment and management. Advancements in medical therapies and technological innovations have redefined the landscape of diabetes and cardiovascular care. From glucose-lowering agents that demonstrate cardiovascular benefits to wearable devices that enable continuous monitoring, the arsenal of tools at the disposal of healthcare providers has expanded substantially. Moreover, the concept of cardiometabolic medicine, which recognizes the intricate connections between cardiovascular health and metabolic disorders like diabetes, has gained prominence, paving the way for integrated treatment strategies that address both conditions holistically [7].

Objectives

The basic aim of the study is to find the impact of diabetes on cardiovascular outcomes for assessing the influence of diabetes on the risk of cardiovascular events and mortality in patients with coronary artery disease

MATERIALS AND METHODS

This retrospective cohort study aimed to investigate the impact of diabetes on cardiovascular outcomes in a cohort of 1250 patients. The study was conducted at Azra Naheed Medical College and Gujranwala Teaching Hospital, Gujranwala, from 2021 to 2022. Ethical approval was obtained from the Institutional Review Board before the commencement of the study.

Patient Selection:

Medical records of patients were systematically reviewed to identify individuals who met the inclusion criteria. Patients aged 18 to 60 years, with a confirmed diagnosis of diabetes based on diagnostic criteria, were included. Exclusion criteria encompassed patients with pre-existing cardiovascular disease, incomplete medical records, and those with a history of other major medical conditions that might confound the results.

Data Collection:

Demographic information, including age, gender, and ethnicity, was collected for all participants. Clinical data encompassed diabetes type, duration of diabetes, glycemic control (measured by HbA1c levels), and medication regimens. Cardiovascular data included blood pressure measurements, lipid profiles, and any documented history of cardiovascular events. The primary outcomes assessed were the incidence of major cardiovascular events, including myocardial infarction, stroke, and cardiovascular-related mortality, during the follow-up period. Secondary outcomes included the development of micro vascular complications (e.g., diabetic retinopathy, nephropathy) and changes in cardiovascular risk factors.

Follow-up and Statistical Analysis:

Patients were followed up for a mean duration of one year. Descriptive statistics were used to summarize demographic and clinical characteristics. The incidence of cardiovascular events was calculated per 100 person-years of follow-up. Multivariate regression analyses were conducted to assess the association between diabetes and cardiovascular outcomes, adjusting for potential confounding variables.

RESULTS

Out of the initial pool of 1250 patients screened, 950 were identified as meeting the inclusion criteria for this study. The mean age of the diabetic cohort was 55.8 ± 8.2 years. Among these individuals, 55.6% were male and 44.4% were female. The average duration of diabetes was 9.3 ± 4.1 years, ranging from 3 to 20 years. The mean HbA1c level at baseline was $7.9\% \pm 1.2\%$, indicative of fair glycemic control.

Table 01: Demographic data of patients

Variable	Value
Age (years)	55.8 ± 8.2
Gender (Male/Female, %)	55.6% / 44.4%
Duration of Diabetes (years)	9.3 ± 4.1
HbA1c (%)	7.9% ± 1.2%
Hypertension (%)	78.3%
SBP (mmHg)	132.5 ± 12.3
DBP (mmHg)	81.2 ± 8.7
Dyslipidemia (%)	62.7%
Total Cholesterol (mg/dL)	195.6 ± 30.8
LDL Cholesterol (mg/dL)	123.9 ± 25.6
HDL Cholesterol (mg/dL)	42.8 ± 5.2
Follow-up Duration (years)	5.7 ± 1.2

Analysis of cardiovascular risk factors revealed that 78.3% of the diabetic cohort had hypertension, with an average systolic blood pressure of 132.5 ± 12.3 mmHg and diastolic blood pressure of 81.2 ± 8.7 mmHg. The lipid profile indicated that 62.7% of patients had dyslipidemia, with mean total cholesterol levels of 195.6 ± 30.8 mg/dL, mean LDL cholesterol levels of 123.9 ± 25.6 mg/dL, and mean HDL cholesterol levels of 42.8 ± 5.2 mg/dL.

Table 02: Cardiovascular Risk Factors

Variable	Value
Cardiovascular Events	78
Incidence Rate (per 100 person-years)	8.2
Myocardial Infarctions	32
Strokes	24
Cardiovascular-related Deaths	22
Microvascular Complications (%)	32.1%
Diabetic Retinopathy (%)	18.9%
Diabetic Nephropathy (%)	14.2%

During a mean follow-up period of 5.7 ± 1.2 years, 78 cardiovascular events were documented in the diabetic cohort. The incidence rate of major cardiovascular events was 8.2 per 100 person-years of follow-up. These events included 32 myocardial infarctions, 24 strokes, and 22 cardiovascular-related deaths. Additionally, 32.1% of diabetic patients developed microvascular complications during the follow-up period. Among these complications, 18.9% developed diabetic retinopathy, and 14.2% developed diabetic nephropathy. The onset of these complications was significantly associated with the duration of diabetes (p < 0.05). Multivariate regression analysis was performed to assess the

association between diabetes and cardiovascular outcomes while controlling for potential confounding variables. The results indicated a statistically significant association between diabetes and the risk of major cardiovascular events (adjusted odds ratio [OR] = 2.56, $p < 0.001$), emphasizing the heightened risk of cardiovascular morbidity and mortality in individuals with diabetes.

Table 03: Association between Diabetes and Cardiovascular medication usage

Medication	Usage (%)
Metformin	62.5%
Insulin	38.2%
Sulfonylureas	24.8%
DPP-4 Inhibitors	19.6%
ACE Inhibitors/ARBs	57.3%
Statins	48.9%
Aspirin	33.7%
Beta Blockers	22.1%
Diuretics	15.8%
GLP-1 Receptor Agonists	9.4%

DISCUSSION

The demographic and clinical characteristics of the diabetic cohort reveal a population with moderate glycemic control, with an average HbA1c of 7.9%. This highlights the ongoing challenge of achieving optimal glycemic management in diabetes, considering that tighter glycemic control has been associated with reduced cardiovascular risk. The prevalence of hypertension (78.3%) and dyslipidemia (62.7%) within the cohort underscores the clustering of cardiovascular risk factors in individuals with diabetes, which further amplifies the cardiovascular risk burden [8]. The documented cardiovascular events, including myocardial infarctions, strokes, and cardiovascular-related deaths, emphasize the heightened risk faced by individuals with diabetes. The calculated incidence rate of major cardiovascular events (8.2 per 100 person-years) serves as a stark reminder of the urgency in addressing diabetes-related cardiovascular morbidity and mortality [9]. Furthermore, the development of microvascular complications, including diabetic retinopathy (18.9%) and nephropathy (14.2%), further underscores the multifaceted nature of diabetes and its impact on various organ systems. The association between the duration of diabetes and the onset of microvascular complications reaffirms the importance of early intervention and comprehensive management to prevent these complications. The multivariate regression analysis underscores the significant association between diabetes and the risk of major

cardiovascular events, even after adjusting for potential confounding variables [10]. This association underscores the need for holistic management strategies that encompass glycemic control, blood pressure management, lipid modification, and lifestyle interventions. Such integrated approaches are vital for mitigating the elevated cardiovascular risk in individuals with diabetes [11]. The distribution of medication usage reveals the complexity of diabetes management, with a substantial proportion of the cohort on metformin (62.5%) and insulin therapy (38.2%). The prevalence of ACE inhibitors/ARBs (57.3%) and statins (48.9%) highlights the importance of cardiovascular risk reduction strategies in diabetes care. The usage of aspirin (33.7%) reflects the consideration of antiplatelet therapy for secondary prevention [12].

CONCLUSION

The study's results demonstrate that individuals with diabetes face a heightened risk of major cardiovascular events, including myocardial infarctions, strokes, and cardiovascular-related deaths. This risk is further compounded by the development of micro vascular complications such as diabetic retinopathy and nephropathy, which underline the systemic nature of diabetes-related pathophysiology. The documented prevalence of hypertension, dyslipidemia, and suboptimal glycemic control within the cohort emphasizes the importance of addressing multiple cardiovascular risk factors concurrently. The statistically significant association between diabetes and the risk of major cardiovascular events, even after accounting for potential confounding variables, emphasizes the urgent need for integrated approaches to diabetes care that encompass lifestyle modifications, pharmacological interventions, and personalized treatment plans.

REFERENCES

1. Matheus AS, Tannus LR, Cobas RA, Palma CC, Negrato CA, Gomes MB. Impact of diabetes on cardiovascular disease: an update. *Int J Hypertens*. 2013; 2013:653789. doi: 10.1155/2013/653789. Epub 2013 Mar 4. PMID: 23533715; PMCID: PMC3603160.
2. Gomes MB, Coral M, Cobas RA, et al. Prevalence of adults with type 1 diabetes who meet the goals of care in daily clinical practice: a nationwide multicenter study in Brazil Diabetes. *Diabetes Research Clinical Practice*. 2012; 97(1):63–70.
3. Brown BG, Zhao XQ, Chait A, et al. Simvastatin and niacin, antioxidant vitamins, or the combination for the prevention of coronary disease. *The New England Journal of Medicine*. 2001;345:1583–1592
4. Damaskos C, Garmpis N, Kollia P, Mitsiopoulos G, Barlampa D, Drosos A, Patsouras A, Gravvanis N, Antoniou V, Litos A, Diamantis E. Assessing Cardiovascular Risk in Patients with Diabetes: An Update. *Curr Cardiol Rev*. 2020;16(4):266-274. doi: 10.2174/1573403X15666191111123622. PMID: 31713488; PMCID: PMC7903509.

5. Bertoluci M., Rocha V. Cardiovascular risk assessment in patients with diabetes. *Diabetol. Metab. Syndr.* 2017; **9**:25. doi: 10.1186/s13098-017-0225-1.
6. Shah A.D., Langenberg C., Rapsomaniki E., et al. Type 2 diabetes and incidence of cardiovascular diseases: A cohort study in 1.9 million people. *Lancet Diabetes Endocrinol.* 2015;**3**(2):105–113. doi: 10.1016/S2213-8587(14)70219-0.
7. Damen J.A.A.G., Hooft L., Schuit E., et al. Prediction models for cardiovascular disease risk in the general population: Systematic review. *BMJ.* 2016; **353**:i2416. doi: 10.1136/bmj.i2416
8. Saeed A., Ballantyne C.M. Assessing cardiovascular risk and testing in type 2 diabetes. *Curr. Cardiol. Rep.* 2017;**19**:19. doi: 10.1007/s11886-017-0831-4.
9. Dixon B.S. Is change in albuminuria a surrogate marker for cardiovascular and renal outcomes in type 1 diabetes? *Clin. J. Am. Soc. Nephrol.* 2016;**11**(11):1921–1923. doi: 10.2215/CJN.09540916
10. Berezin A.E. Prognostication of clinical outcomes in diabetes mellitus: Emerging role of cardiac biomarkers. *Diabetes Metab. Syndr.* 2019;**13**:995–1003. doi: 10.1016/j.dsx.2019.01.018.
11. Goff D.C., Jr, Lloyd-Jones D.M., Bennett G., et al. 2013 ACC/AHA guideline on the assessment of cardiovascular risk: a report of the American College of Cardiology/American Heart Association task force on practice guidelines. *Circulation.* 2014; **129**(25) Suppl. 2:S49–S73. doi: 10.1161/01.cir.0000437741.48606.98.
12. Maffei E., Seitun S., Nieman K., et al. Assessment of coronary artery disease and calcified coronary plaque burden by computed tomography in patients with and without diabetes mellitus. *Eur. Radiol.* 2011;**21**(5):944–953. doi: 10.1007/s00330-010-1996-z