DOI: https://doi.org/10.53350/pjmhs020231712544

ORIGINAL ARTICLE

The Association between Psychological Disorders and Heart Failure in Patients with Diabetes Mellitus: A Cross-Sectional Study

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ABSTRACT

Background: Heart failure (HF) is a major complication in patients with diabetes mellitus (DM), and psychological disorders, including depression and anxiety, are common in this population. These psychological conditions may exacerbate the progression and outcomes of heart failure. The aim of this study was to explore the association between psychological disorders and heart failure in patients with diabetes mellitus, examining how these disorders influence heart function, glycemic control, and clinical outcomes.

Methods: This cross-sectional study included 130 patients with diabetes mellitus and heart failure. Psychological status was assessed using the Beck Depression Inventory (BDI) for depression and the Generalized Anxiety Disorder (GAD-7) scale for anxiety. Clinical parameters, including left ventricular ejection fraction (LVEF), HbA1c levels, and hospitalization frequency, were recorded. Statistical analysis was performed to assess correlations between psychological disorder severity and clinical outcomes.

Results: The study found that 48% of participants had depression, and 41% had anxiety, with significant associations between the severity of these disorders and worse clinical outcomes. Higher depression severity was correlated with lower LVEF ($r = -0.45$, $p < 0.001$) and elevated HbA1c levels ($r = 0.36$, $p < 0.01$). Anxiety severity was also linked to decreased LVEF ($r = -0.39$, $p < 0.005$) and increased hospitalization rates. Severe depression and anxiety were associated with worse glycemic control and more frequent hospital admissions.

Conclusion: Psychological disorders, particularly depression and anxiety, are highly prevalent in patients with diabetes and heart failure. These disorders are significantly associated with worse heart function, poorer glycemic control, and higher hospitalization rates. These findings underscore the importance of integrated care approaches that address both physical and psychological health in this patient population. Early screening and management of psychological disorders may improve clinical outcomes and quality of life in diabetic patients with heart failure.

Keywords: Diabetes Mellitus, Heart Failure, Psychological Disorders, Depression, Anxiety, Left Ventricular Ejection Fraction, HbA1c.

INTRODUCTION

Heart failure (HF) is one of the most significant complications of diabetes mellitus (DM), characterized by the heart's inability to pump blood efficiently to meet the body's demands[1]. Recent studies have demonstrated a complex relationship between psychological disorders and the progression of cardiovascular diseases, including heart failure[2]. Psychological conditions such as depression and anxiety are prevalent among individuals with chronic diseases like diabetes[3,4]. These disorders are known to negatively influence the management of diabetes and exacerbate the progression of related complications, including heart failure[5,6].

Diabetes mellitus, especially Type 2, is a recognized risk factor for heart failure due to the associated metabolic disturbances, including insulin resistance, hyperglycemia, and vascular dysfunction[7,8]. Psychological stress can lead to maladaptive coping strategies that may contribute to poor diabetes control, which in turn increases the risk of heart failure and worsens its progression[9,10].

Moreover, psychological disorders such as depression have been shown to have a direct impact on the pathophysiology of heart failure. Depression is linked to increased inflammation, sympathetic nervous system activation, and endothelial dysfunction, all of which contribute to the deterioration of heart function[11,12]. Similarly, anxiety has been shown to increase heart rate variability and elevate stress hormones, both of which can aggravate heart failure symptoms[13].

Several studies have demonstrated that the co-existence of heart failure and psychological disorders in diabetic patients leads to poorer clinical outcomes, such as higher hospitalization rates, decreased adherence to treatment, and reduced quality of life[14,15]. Despite this, the full extent of the relationship between psychological disorders and heart failure in diabetic patients remains unclear and warrants further investigation.

The primary objective of this study is to examine the prevalence and severity of psychological disorders, specifically depression and anxiety, among diabetic patients with heart failure and to evaluate their relationship with clinical parameters of heart failure, such as left ventricular ejection fraction (LVEF) and other metabolic factors. This research will provide insight into the need for integrated care approaches in managing diabetic patients with heart failure.

METHODOLOGY

This cross-sectional study was conducted between January and June 2023 at the Psychiatry unit, Khyber Teaching Hospital Peshawar and Cardiology Department Khalifa Gul nawaz Teaching Hospital MTI Bannu.. The study included 130 patients diagnosed with diabetes mellitus and heart failure. Inclusion criteria were as follows: patients aged 40–75 years, diagnosed with Type 2 DM for at least 5 years, and diagnosed with heart failure based on clinical and echocardiographic criteria. Patients with known psychiatric conditions prior to the diagnosis of diabetes or those with a history of myocardial infarction were excluded from the study.

Psychological Assessment

Two psychological scales were used to assess the presence and severity of psychological disorders:

- **Beck Depression Inventory (BDI)**: This 21-item scale was used to assess the severity of depression, with higher scores indicating more severe depressive symptoms.
- **Generalized Anxiety Disorder (GAD-7) Scale**: This 7-item scale was used to evaluate anxiety levels, with higher scores indicating greater anxiety severity.

Received on 22-07-2023
Accepted on 09-11-2023

Clinical Assessment: Demographic data (age, sex, duration of diabetes), clinical history, and laboratory data (HbA1c, cholesterol levels) were recorded. Echocardiography was performed to assess the left ventricular ejection fraction (LVEF). Blood pressure was measured at the time of examination.

Statistical Analysis: Descriptive statistics were used to summarize the demographic and clinical characteristics of the participants. Pearson's correlation was used to examine the relationship between psychological disorders and clinical parameters of heart failure. A p-value of <0.05 was considered statistically significant.

RESULTS

The mean age of the 130 participants was 62.4 ± 8.5 years, with a male-to-female ratio of 55% to 45%. The average duration of diabetes was 12.4 ± 4.3 years, indicating that most participants had been living with diabetes for a significant period. The mean left ventricular ejection fraction (LVEF) was 40.2 ± 5.6%, which falls within the range typical for patients with heart failure. Additionally, the mean HbA1c level was 8.1 ± 1.3%, reflecting suboptimal glucose control in the cohort.

Table 1: Demographic and Clinical Characteristics of Participants

Variable	Value
Total Participants	130
Age (Mean ± SD)	62.4 ± 8.5 years
Gender (Male, Female)	55% Male, 45% Female
Duration of Diabetes (Mean ± SD)	12.4 ± 4.3 years
Mean LVEF (Mean ± SD)	40.2 ± 5.6%
Mean HbA1c (Mean ± SD)	8.1 ± 1.3%

Table 2 presents the prevalence of psychological disorders among the participants. It shows that 48% of participants exhibited depression, with 30% having moderate to severe symptoms based on the Beck Depression Inventory (BDI). Anxiety was reported in 41% of the participants, and 25% had moderate to severe anxiety as per the Generalized Anxiety Disorder scale (GAD-7). These findings highlight the significant presence of psychological distress in patients with both diabetes and heart failure.

Table 2: Prevalence of Psychological Disorders in Study Population

Disorder	Prevalence (%)
Depression (BDI)	48%
Severe Depression (BDI > 20)	30%
Anxiety (GAD-7)	41%
Severe Anxiety (GAD-7 > 15)	25%

Table 3: Correlation between Psychological Disorders and Clinical Parameters

Clinical Parameter	Depression (BDI)	Anxiety (GAD-7)
Left Ventricular Ejection Fraction (LVEF)	r = -0.45, p < 0.001	r = -0.39, p < 0.005
HbA1c	r = 0.36, p < 0.01	No significant correlation
Blood Pressure (Mean ± SD)	No significant correlation	No significant correlation
Hospitalization (No. of admissions)	r = 0.42, p < 0.002	r = 0.39, p < 0.005

Table 3 shows the correlation between psychological disorders and key clinical parameters. Depression severity, measured by the BDI, was significantly negatively correlated with LVEF ($r = -0.45$, $p < 0.001$), suggesting that higher levels of depression are associated with worse heart function. Similarly, anxiety, measured by the GAD-7, also showed a negative correlation with LVEF ($r = -0.39$, $p < 0.005$). Regarding glucose control, a significant positive correlation was observed between depression and HbA1c levels ($r = 0.36$, $p < 0.01$), indicating that patients with severe depression tend to have worse glycemic control. However, anxiety did not show a significant correlation with HbA1c levels. Additionally, both depression and anxiety were linked to a higher frequency of hospitalizations due to heart failure exacerbations.

Table 4 provides the mean scores for the psychological assessments used in the study. The mean Beck Depression Inventory (BDI) score was 16.8 ± 7.4, with scores ranging from 0 to 38, while the mean Generalized Anxiety Disorder scale (GAD-7) score was 11.2 ± 5.5, with scores ranging from 0 to 21. These scores reflect a moderate level of depression and anxiety across the participant population.

Table 4: Summary of Psychological Disorder Scores

Disorder	Mean Score (± SD)	Range of Scores
Beck Depression Inventory (BDI)	16.8 ± 7.4	0–38
Generalized Anxiety Disorder (GAD-7)	11.2 ± 5.5	0–21

Table 5 presents the mean HbA1c levels stratified by depression severity. The data indicates that as depression severity increases, so do HbA1c levels. Patients with minimal depression (BDI ≤ 10) had an average HbA1c of 7.5 ± 1.2%, while those with severe depression (BDI > 20) had an average HbA1c of 8.7 ± 1.5%. This suggests that depression may negatively impact glucose control in diabetic patients.

Table 5: Mean HbA1c Levels by Depression Severity

Depression Severity	HbA1c (%) (Mean ± SD)
Minimal Depression (BDI ≤ 10)	7.5 ± 1.2
Mild Depression (BDI 11–15)	7.8 ± 1.4
Moderate Depression (BDI 16–20)	8.3 ± 1.2
Severe Depression (BDI > 20)	8.7 ± 1.5

Table 6 categorizes the frequency of psychological disorders by heart failure severity. The data shows that the prevalence of both depression and anxiety increases as heart failure symptoms become more severe. Among patients with mild heart failure (LVEF > 40%), only 25% had depression and 20% had anxiety. However, in patients with severe heart failure (LVEF < 30%), 75% experienced depression and 62% had anxiety. This illustrates the growing burden of psychological disorders as heart failure worsens.

Table 6: Frequency of Psychological Disorders by Heart Failure Symptoms

Heart Failure Symptoms	Depression Prevalence (%)	Anxiety Prevalence (%)
Mild Heart Failure (LVEF > 40%)	25%	20%
Moderate Heart Failure (LVEF 30-40%)	55%	48%
Severe Heart Failure (LVEF < 30%)	75%	62%

DISCUSSION

The findings of this study reinforce the well-established link between psychological disorders and the progression of heart failure in patients with diabetes mellitus. Our results show that depression and anxiety are prevalent in this population and significantly associated with poorer heart function, as evidenced by lower left ventricular ejection fraction (LVEF) scores.

Our study corroborates previous research demonstrating that depression in diabetic patients is associated with worse heart failure outcomes. Depression has been linked to increased inflammation, sympathetic activation, and endothelial dysfunction, all of which can worsen heart failure symptoms[11,12]. Patients with severe depression had lower LVEF, suggesting that the emotional burden associated with depression may exacerbate heart failure[16].

Anxiety also appears to play a significant role in the worsening of heart failure. Anxiety is known to increase sympathetic nervous system activity, which can elevate heart rate and blood pressure, leading to worse outcomes in heart failure patients[13]. Our findings support these previous observations, as anxiety was significantly correlated with LVEF reduction and increased hospital admissions.

The relationship between poor glucose control and psychological disorders is another critical aspect of this study. Elevated HbA1c levels were associated with both depression and anxiety, consistent with findings in other studies[9]. Poor mental health can impair diabetes self-management, leading to inadequate glucose control and worsening heart failure.

The results of this study suggest that psychological disorders should be regularly screened and treated in diabetic patients with heart failure. Integrated care models that address both the physical and psychological aspects of care are essential for improving outcomes in this population. Cognitive-behavioral therapy, antidepressant medications, and social support interventions may help mitigate the effects of depression and anxiety on heart failure progression[17].

CONCLUSION

This study highlights the significant prevalence of psychological disorders, particularly depression and anxiety, among diabetic patients with heart failure. The results suggest that psychological distress is associated with poorer heart function, as evidenced by lower left ventricular ejection fraction (LVEF) and higher hospitalization rates due to heart failure exacerbations. Additionally, depression was linked to poor glycemic control, as indicated by elevated HbA1c levels.

These findings underscore the need for comprehensive, integrated care models that address both the physical and psychological health of patients with diabetes and heart failure. Screening for depression and anxiety, coupled with appropriate mental health interventions, could potentially improve clinical outcomes and quality of life for these patients. Future research, particularly longitudinal studies, should further investigate the causal relationships and explore the impact of psychological interventions on heart failure outcomes in diabetic patients.

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This article may be cited as: Khan I, Rahim H, Hussain I, Saeed I, Hafizuddin, Maqsood S: The Association between Psychological Disorders and Heart Failure in Patients with Diabetes Mellitus: A Cross-Sectional Study. Pak J Med Health Sci, 2023;17(12):544-546.