Exploring Factors Associated with Depression and Anxiety among Hospitalized Patients with Type 2 Diabetes Mellitus

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Significance of the Study
- In this study, the factors that increased the risk of anxiety were physical inactivity and hospitalization for 8 days or longer, and those of depression were older age, low income, and nephropathy. Anxiety and depression in hospitalized diabetic patients could increase the risk of morbidity and mortality. Hence, screening for anxiety and depression is recommended in hospitalized patients with diabetes.

Keywords
Depression · Anxiety · Internal medicine · Diabetes

Abstract
Objectives: The aims of the current study were to determine the prevalence and severity of anxiety and depression, and to explore associated factors among hospitalized patients with type 2 diabetes mellitus. Subjects and Methods: All patients with type 2 diabetes (160 patients) who were admitted to the Internal Medicine Wards of the King Abdulaziz Medical City, Riyadh, Saudi Arabia, from January to August 2015 were asked to participate, and 158 patients agreed to do so. A self-administered questionnaire consisting of 2 parts was used. The first part was on sociodemographic information, and the second part was a validated screening tool for assessing depression and anxiety. The severity of anxiety and depression was classified as normal, mild, moderate, and severe. Logistic regression was carried out to identify variables that were independently associated with anxiety and depression. Results: Using the screening tool, 85 (53.8\%) and 80 (50.6\%) study patients were identified as patients who suffered from depression and anxiety, respectively. The severity of distress was moderate/severe in 36 (42.4\%) patients with depression and 41 (51.3\%) patients with anxiety. The factors independently associated with the risk for anxiety in hospitalized patients with diabetes were physical inactivity and staying 8 days or longer in the hospital. On the other hand, factors that were independently associated with the risk for depression were older age, low income, and nephropathy. Conclusion: The majority of hospitalized patients with diabetes developed moderate/severe anxiety or depression, or both, during hospitalization. Hence, screening for anxiety and depression in high-risk hospitalized diabetic patients is recommended during hospitalization.

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Introduction

Diabetes mellitus is one of the most common chronic disorders that affects millions of people worldwide [1] with a prevalence that is increasing rapidly globally and at an alarming rate especially in the Middle East and North Africa region region [2, 3]. According to the International Diabetes Federation, more than 415 million people have diabetes in the world, and more than 35.4 million of these people are in the Middle East and North Africa region; it is predicted that the number will rise to 72.1 million people with diabetes by 2040 [2].

Complications and comorbidities are of particular concern in diabetes. Diabetes is usually accompanied by many comorbidities such as hypertension, dyslipidemia, and cardiovascular diseases [3]. Uncontrolled diabetes mellitus also leads to the development of many microvascular complications such as nephropathy, retinopathy, and neuropathy as well as macrovascular complications [4]. These complications and comorbidities, together with the emotional stress associated with the diagnosis of diabetes, had been linked to the development of depression and anxiety among diabetic patients [5, 6]. It was estimated that diabetic patients have at least twice the risk of depression or anxiety compared to the general population [7, 8]. Equally important, anxiety and depression in diabetic patients had been associated with increased risk of comorbidities, interference with daily activities and quality of life, higher health care costs, and more complications when compared to normal patients [7, 9, 10].

A recent meta-analysis of 16 studies had revealed an alarming significant association between depression and increased risk of mortality (odds ratio, OR = 1.5) in patients with diabetes [11]. A study had shown that it is common for both anxiety and depression to be present together in diabetic patients, forming what can be described as anxious depression, which was identified as a strong predictor of cardiovascular outcomes [12]. Conversely, identifying and treating anxiety and depression can contribute to improved clinical outcomes [13, 14]. Therefore, it would be imperative to investigate factors that contribute to anxiety and depression in patients with diabetes, identify patients at risk, and intervene to reduce the risk of developing anxiety or depression or both if possible. Thus far, many studies had explored factors associated with anxiety and depression among diabetic patients in outpatient settings and were able to identify several demographic, behavioral, and clinical factors that could predispose diabetic patients to depression and anxiety [7, 15, 16]. However, there is limited information about the prevalence and risk factors for anxiety and depression among hospitalized patients with diabetes. Hence, the aims of the current study were to determine the prevalence and severity of anxiety and depression, and also to explore associated factors among hospitalized patients with type 2 diabetes mellitus.

Materials and Methods

Design and Setting

A cross-sectional study was conducted at the Internal Medicine Wards, King Abdulaziz Medical City (KAMC), Riyadh, Saudi Arabia, from January to August 2015. The KAMC is a 1,200-bed tertiary-care hospital in Riyadh. The study was approved by the Institutional Review Board of the King Abdulrahman International Medical Research Center. A written informed consent was obtained from participants who agreed to participate in the study.

Study Participants

One hundred and sixty (160) adult patients (>18 years) with type 2 diabetes who were admitted to the internal medicine wards during the study period were eligible for inclusion in this study. Diagnosis of type 2 diabetes was obtained from the patient’s medical records. The inclusion criterion was a hospital stay of at least 2 days. Exclusion criteria were a previous clinical diagnosis of anxiety, depression, and other psychiatric disorder. Hence, 2 patients were excluded due to documented major depressive disorder, and 158 patients were included in the study; 122 were above 60 years of age and had uncontrolled diabetes mellitus.

Data Collection

In this study, a self-administered questionnaire consisting of 2 parts was used. The first part included patients’ sociodemographic information (educational level, marital status, income, living status, job status, physical activity during hospitalization, smoking, age, and gender). The second part was a screening tool for anxiety and depression. The Arabic version of the Hospital Anxiety and Depression Scale (HADS) [17, 18] had been validated for use in various clinical settings including diabetes [7] and hence was used in this study. The tool was self-administered; however, in case of illiteracy or poor vision, the items and possible responses were read to the participant [19]. HADS consists of 14 items that ask the patients to reflect on their mood in the past week: 7 items assess anxiety and 7 items assess depression. Scores for items in each HADS subscale were summed to produce an anxiety score (HADS-A) or a depression score (HADS-D). Each item was scored from 0 (not present) to 3 (present) [7]. Each subscale was scored as normal: 0–7; mild distress (caseness): 8–10; moderate distress: 11–14; and severe distress: 15–21.

Clinical information (medical history, diagnosis of diabetes, medication history, laboratory data, blood pressure, and fasting plasma glucose), comorbidities, and complications (including nephropathy, retinopathy, neuropathy, stroke, hypertension, heart failure, dyslipidemia, peripheral vascular disease, and ischemic heart disease) were obtained from the patients’ medical records. Based on the American Diabetes Association guidelines (2017), glycemic control was defined as HbaA1c (glycosylated hemoglobin) <7% and fasting plasma glucose ≤7.2 mmol/L (average during the hospital stay). Blood pressure control was determined in accor-
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Analysis of Outcome Measures and Data
Data entry and analyses were carried out using the Statistical Package for the Social Sciences (SPSS®) (version 21.0; IBM, Armonk, NY, USA). Main study outcomes were the prevalence of anxiety and depression in hospitalized patients with diabetes and factors associated with anxiety and depression. Anxiety and depression scores were expressed as means ± SD. Univariate analysis was used to investigate the association between outcome variables (anxiety, depression) and sociodemographic and clinical variables using the χ² test, Student t test, and analysis of variance (ANOVA), as appropriate; p < 0.05 was considered statistically significant. Variables that were identified as significant using univariate analysis were further investigated using multivariate analysis. Multivariate analysis using multiple logistic regression (backward elimination: Wald) was carried out to identify variables that were independently associated with anxiety and depression among persons with type 2 diabetes. Results of logistic regression are expressed as OR with 95% confidence interval (CI).

Results

Demographic and clinical characteristics of the study sample are shown in Table 1. The mean age of the participants was 67.2 ± 12.6 years.

Prevalence of Anxiety and Depression
Of the 158 patients, 85 (53.8%) were suffering from depression, while 80 (50.6%) were suffering from anxiety (Table 2). The severity of distress was moderate/severe in 36 (42.4%) patients with depression and 41 (51.3%) patients with anxiety. Additionally, 52 (32.9%) patients had both anxiety and depression.

Factors Associated with Anxiety
Demographic factors associated with anxiety and depression are presented in Table 3. Clinical factors associated with anxiety and depression are presented in Table 4.

Factors that were associated with anxiety in hospitalized diabetic patients were: physical inactivity (79 [58.5%] inactive vs. 56 active patients [41.5%], p = 0.03), longer hospital stay (5.18 vs. 8.15 days, p = 0.002), and the number of complications (20 [58.8%] patients with ≥2 vs. 14 patients with ≤2 complications [41.2%], p = 0.03) (Tables 3, 4).

Further analysis using logistic regression (Table 5) showed that physical inactivity and longer hospital stay were independently associated with anxiety (p < 0.05). The risk of anxiety in physically inactive patients was 2.8 times higher than in physically active patients.

Table 1. Demographic and clinical characteristics of the study patients (n = 158)

| Characteristics                  | n  | (%)  |
|----------------------------------|-----|------|
| Age (mean ± SD), years           | 67.2 ± 12.6 |
| Gender, n (%)                    |     |      |
| Male                             | 84  | (53.2) |
| Female                           | 74  | (46.8) |
| Marital status, n (%)            |     |      |
| Single                           | 3   | (1.9)  |
| Married                          | 105 | (66.4) |
| Widowed                          | 38  | (24.1) |
| Divorced                         | 12  | (7.6)  |
| Income, n (%)                    |     |      |
| >10,000 SR                       | 38  | (24.0) |
| 5,000–10,000 SR                  | 27  | (17.1) |
| <5,000 SR                        | 93  | (58.9) |
| Education, n (%)                 |     |      |
| University degree                | 18  | (11.4) |
| Secondary and high school        | 33  | (20.9) |
| Primary school                   | 36  | (22.8) |
| Illiterate                       | 71  | (44.9) |
| Job status, n (%)                |     |      |
| Retired                          | 78  | (49.4) |
| Unemployed                       | 63  | (39.9) |
| Employed                         | 17  | (10.8) |
| Smoking, n (%)                   |     |      |
| Non-/ex-smoker                   | 147 | (93)   |
| Current smoker                   | 11  | (7)    |
| BMI (mean ± SD)                  | 30.52 ± 7.61 |
| Fasting blood glucose (mean ± SD), mmol/L | 10.14 ± 3.97 |
| Duration of diabetes (mean ± SD), years | 15.48 ± 9.74 |
| HbA1c (mean ± SD), %             | 8.56 ± 1.94 |
| Control of diabetes, n (%)       |     |      |
| Controlled                       | 34  | (21.5) |
| Uncontrolled                     | 122 | (77.2) |
| Types of medications, n (%)      |     |      |
| Lifestyle only                   | 22  | (13.9) |
| Insulin use                      | 100 | (63.3) |
| Oral agents only                 | 36  | (22.8) |
| Length of hospital stay (mean ± SD), days | 6.68 ± 6.01 |
| Presence of micro- and macrovascular complications, n (%) |     |      |
| Yes                              | 118 | (74.6) |
| No                               | 40  | (25.3) |
| Number of comorbidities (mean ± SD) | 2.9 ± 1.1 |
| Hypertension                     | 116 | (73.4) |
| Ischemic heart disease           | 66  | (41.8) |
| Dyslipidemia                     | 64  | (40.5) |
| Heart failure                    | 48  | (30.4) |
| Stroke                           | 17  | (10.8) |
| Nephropathy                      | 34  | (21.5) |
| Neuropathy                       | 5   | (3.1)  |
| Retinopathy                      | 5   | (3.1)  |
Table 2. Prevalence of anxiety and depression among hospitalized diabetic patients (n = 158)

|                      | Average score, mean ± SD | Normal, n (%) | Anxiety or depression present, n (%) |
|----------------------|--------------------------|---------------|--------------------------------------|
|                      |                          |               | total | mild | moderate | severe |
| Depression           | 7.9 ± 3.8                | 73 (46.2)     | 85 (53.8) | 49 (31.0) | 27 (17.1) | 9 (5.7) |
| Anxiety              | 7.9 ± 4.3                | 78 (49.4)     | 80 (50.6) | 39 (24.7) | 27 (17.1) | 14 (8.9) |
| No anxiety/depression| NA                       | 45 (28.5)     | NA     | NA   | NA       | NA     |

Table 3. Demographic factors associated with anxiety and depression (univariate analysis)

|                      | Depression | Anxiety | |                      | Depression | Anxiety | |
|----------------------|------------|---------| |                      |            |         | |
|                      | absent     | present | p value |                      | absent     | present | p value |
| Age (mean ± SD), years | 62.1 ± 12.1 | 71.6 ± 11.5 | 0.0001 | 66.8 ± 11.6 | 67.5 ± 13.6 | 0.767 |
| Gender, n (%)         | Male       | 41 (48.8) | 43 (51.2) | 0.484 | 47 (56.0) | 37 (44.0) | 0.078 |
|                      | Female     | 32 (43.2) | 42 (56.8) | NA   | 31 (41.9) | 43 (58.1) | |
| Education level, n (%) | University degree | 10 (55.6) | 8 (44.4) | 0.002 | 12 (66.6) | 6 (33.3) | 0.116 |
|                      | Secondary high school | 24 (72.7) | 9 (27.3) | | 18 (54.5) | 15 (45.5) | |
|                      | Primary school | 19 (52.8) | 17 (47.2) | | 16 (44.4) | 20 (55.6) | |
|                      | Illiterate | 22 (31.0) | 49 (69.0) | | 27 (38.0) | 44 (62.0) | |
| Marital status, n (%) | Widowed | 18 (47.4) | 20 (52.6) | 0.329 | 16 (42.1) | 22 (57.9) | 0.135 |
|                      | Divorced | 4 (33.3) | 8 (66.7) | | 2 (16.7) | 10 (83.3) | |
|                      | Married | 49 (46.7) | 56 (53.3) | | 54 (51.4) | 51 (48.6) | |
|                      | Single | 3 (100.0) | 0 (0.0) | | 3 (100.0) | 0 (0.0) | |
| Income, n (%)         | >10,000 SR | 25 (65.8) | 13 (34.2) | 0.035 | 22 (57.9) | 16 (42.1) | 0.25 |
|                      | 5,000 – 10,000 SR | 15 (55.6) | 12 (44.4) | | 14 (51.9) | 13 (48.1) | |
|                      | <5,000 SR | 36 (38.7) | 57 (61.3) | | 38 (40.9) | 55 (59.1) | |
| Living status, n (%)  | With full family | 48 (49.5) | 49 (50.5) | 0.804 | 48 (49.5) | 49 (50.5) | 0.663 |
|                      | With sons | 20 (40.8) | 29 (59.2) | | 18 (36.7) | 31 (63.3) | |
|                      | With spouse | 5 (50.0) | 5 (50.0) | | 5 (50.0) | 5 (50.0) | |
|                      | Living alone | 1 (50.0) | 1 (50.0) | | 1 (50.0) | 1 (50.0) | |
| Job status, n (%)     | Retired | 33 (42.2) | 45 (57.8) | 0.001 | 38 (48.7) | 40 (51.3) | |
|                      | Unemployed | 25 (39.7) | 38 (60.3) | | 26 (41.3) | 37 (58.7) | 0.698 |
|                      | Employed | 16 (94.1) | 1 (5.9) | | 9 (52.9) | 8 (47.1) | |
| Physical activity, n (%) | Active | 17 (73.9) | 6 (26.1) | 0.010 | 16 (69.6) | 7 (30.4) | 0.032 |
|                      | Inactive | 56 (41.5) | 79 (58.5) | | 56 (41.5) | 79 (58.5) | |
| Smoking, n (%)        | Nonsmoker | 59 (44.7) | 73 (55.3) | 0.480 | 67 (50.8) | 65 (49.2) | 0.310 |
|                      | Ex-smoker | 7 (46.7) | 8 (53.3) | | 8 (53.3) | 7 (46.7) | |
|                      | Current smoker | 7 (63.6) | 4 (36.4) | | 3 (27.3) | 8 (72.7) | |
| BMI (mean ± SD)       | 31.1 ± 9.4 | 30.0 ± 8.1 | 0.368 | 30.2 ± 8.4 | 30.8 ± 6.7 | 0.597 | |

Statistically significant p values are italicized.
times higher than in those who were physically active ($p = 0.026$, CI = 1.13–6.78). Length of hospital stay was also associated with an OR of 1.1 ($p = 0.002$, CI = 1.04–1.19). Further data analysis on this association using ANOVA identified that the severity of anxiety was increasing with longer hospital stay, where the length of stay increased from an average of 5.2 days for patients without anxiety to 7, 8.4, and 10.9 days for patients with mild, moderate, and severe anxiety, respectively ($p = 0.001$). Statistical analysis indicated no association between anxiety and indicators of disease severity such as HbA$_1c$, fasting plasma glucose, and diabetes duration.

**Factors Associated with Depression**

Factors that were associated with depression in hospitalized diabetic patients were older age ($p = 0.0001$), lower educational level ($p = 0.006$), lower income (less than SR [Saudi Riyals] 5,000/USD 1,333 per month) ($p = 0.035$), job status (retired or unemployed) ($p = 0.001$), higher number of complications ($p = 0.03$), hypertension ($p = 0.03$), nephropathy ($p = 0.03$), and physical inactivity ($p = 0.01$) (Tables 3, 4).

Further analysis using logistic regression (Table 5) revealed that older age, lower income, and nephropathy were independently associated with depression ($p < 0.05$). The risk of depression in lower-income patients was 1.96 times increased compared to higher income patients ($p = 0.006$, CI = 1.21–3.18). Patients with nephropathy also had 4.3 times the risk of depression as compared to those without depression ($p = 0.01$, CI = 1.36–13.53). Age was also associated with an OR of 1.08 ($p = 0.0001$, CI = 1.04–1.12). Statistical analysis indicated no association be-

**Table 4. Clinical factors associated with anxiety and depression (univariate analysis)**

|                      | Absent     | Present    | p value | Absent     | Present    | p value |
|----------------------|------------|------------|---------|------------|------------|---------|
| **Diabetes mellitus**, n (%) |            |            |         |            |            |         |
| Controlled           | 18 (21.2)  | 16 (21.9)  | 0.987   | 17 (21.2)  | 17 (21.8)  | 0.996   |
| Uncontrolled         | 66 (77.6)  | 56 (76.7)  |         | 62 (77.5)  | 60 (76.9)  |         |
| **Blood pressure**, n (%) |            |            |         |            |            |         |
| Controlled           | 56 (48.3)  | 60 (51.7)  | 0.660   | 55 (55.6)  | 56 (48.3)  | 0.603   |
| Uncontrolled         | 16 (40.0)  | 24 (60.0)  |         | 17 (42.5)  | 23 (57.5)  |         |
| **Complications**, n (%) |            |            |         |            |            |         |
| 0                    | 17 (42.5)  | 23 (57.5)  | 0.03    | 15 (37.5)  | 25 (62.5)  | 0.03    |
| 1                    | 47 (56.0)  | 37 (44.0)  |         | 50 (59.5)  | 34 (40.5)  |         |
| ≥2                   | 10 (29.4)  | 24 (70.6)  |         | 14 (41.2)  | 20 (58.8)  |         |
| **Hypertension**, n (%) |            |            |         |            |            |         |
| Yes                  | 48 (41.4)  | 68 (58.6)  | 0.03    | 58 (50.0)  | 58 (50.0)  | 1       |
| No                   | 26 (61.9)  | 16 (38.1)  |         | 21 (50.0)  | 21 (50.0)  |         |
| **Dyslipidemia**, n (%) |            |            |         |            |            |         |
| Yes                  | 31 (48.4)  | 33 (51.6)  | 0.75    | 35 (54.7)  | 29 (45.3)  | 0.42    |
| No                   | 43 (45.7)  | 51 (54.3)  |         | 44 (46.8)  | 50 (53.2)  |         |
| **Heart failure**, n (%) |            |            |         |            |            |         |
| Yes                  | 23 (47.9)  | 25 (52.1)  | 0.86    | 20 (60.4)  | 19 (39.6)  | 0.12    |
| No                   | 51 (64.4)  | 59 (35.6)  |         | 50 (45.5)  | 60 (54.5)  |         |
| **Nephropathy**, n (%) |            |            |         |            |            |         |
| Yes                  | 10 (29.4)  | 24 (70.6)  | 0.03    | 16 (47.1)  | 18 (52.9)  | 0.85    |
| No                   | 64 (51.6)  | 60 (48.4)  |         | 63 (50.8)  | 61 (49.2)  |         |

Statistically significant $p$ values are italicized. FPG, fasting plasma glucose.
tween depression and indicators of disease severity such as HbA₁c, fasting plasma glucose, and diabetes duration.

Discussion

In this study, the prevalence of anxiety and depression was very high. More than 50% of hospitalized patients with diabetes showed symptoms of either anxiety or depression, while 32.9% had both anxiety and depression. The severity of distress was moderate/severe in 51.3% of the patients with anxiety and 42.4% in patients with depression. Logistic regression analysis revealed that hospitalized patients with diabetes were more prone to anxiety if they were physically inactive or if they stayed 8 days or longer in hospital. On the other hand, factors that independently increased the risk for depression as identified by logistic regression were older age, lower income, and having nephropathy.

The results of the current study showed a much higher prevalence of anxiety and depression in hospitalized patients than in outpatients with diabetes [21–28]. The higher prevalence identified in the current study could be attributed to the social isolation, reduced mobility, acute illness, and many other factors that are associated with hospital stay. In this study, depression was more common in older patients probably due to higher disease severity, reduced mobility, multiple chronic conditions, and reduced social interactions in older patients. Encouraging social interactions and physical activities could help reduce the occurrence of depression during hospitalization. The effectiveness of such interventions should be investigated.

This study showed that physical inactivity was the only modifiable risk factor which contributed to both depression and anxiety during hospitalization. Physical inactivity and sedentary lifestyle are major problems in Saudi Arabia, as shown in a recent study in which a very high prevalence of physical inactivity among Saudis was reported as the predisposing factor to many diseases [29].

The finding that anxiety was significantly associated with length of hospital stay was important because patients with anxiety had an average length of hospital stay of 8 days or longer compared with an average of 5 days for those without anxiety. The severity of anxiety was also associated with the length of hospital stay. Thus, reducing unnecessary hospital stay in diabetic patients could reduce the possibility of developing anxiety. Since these results indicate only association rather than causality, it should be expected that anxiety could also be contributing to longer hospital stay.

In this study, nephropathy had the strongest impact on depression with a 4 times increased risk. This finding could be related to the many medications, monitoring parameters, and dose adjustments that may be required during hospitalization for patients with nephropathy.

The main limitation of the study was the small sample size. The use of HADS is limited by the fact that this is a screening tool, and that anxiety and depression should be confirmed with clinical diagnosis. A future study should investigate factors affecting anxiety and depression in patients with previous psychiatric illness during hospitalization. In hospitalized patients with diabetes, physical activities and social interactions, which are recommended as strategies for preventing anxiety and depression, should also be explored.

Conclusion

The majority of patients with diabetes had developed moderate/severe anxiety or depression, or both, during hospitalization. Hospitalized patients with diabetes were at higher risk for anxiety if they were physically inactive and stayed 8 days or longer in hospital. The risk for depression was higher in patients with a low income, patients with nephropathy, and older patients. Screening for anxiety and depression in high-risk patients is recommended during hospitalization. Strategies aiming at the prevention of anxiety and depression, such as recommending an acceptable level of physical activities or engaging in social interactions during hospitalization, should be explored.

Disclosure Statement

The authors have no conflict of interest.
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