Original Article

Association of Symptoms of Depression with Disease Burden, Self-Care and Medication Adherence among Persons with Diabetes Mellitus - A Cross-Sectional Study at a Tertiary Care Teaching Hospital in Kerala

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Abstract:

Background: Depression among diabetics may be the unaddressed factor that is preventing glycaemic control that could have been achieved through lifestyle changes and medication adherence. This study aims to estimate the higher risk of poor life style behaviours in those with depression compared to those without to highlight the gravity of comorbid depression in diabetics.

Methods: A cross-sectional survey of adult patients with Type 2 Diabetes Mellitus who were on anti-diabetic medications for more than one year was conducted. Depression was assessed using the Malayalam version of the Patient Health Questionnaire -9; Self-care was assessed using a validated tool consisting of 13 questions, medication adherence and disease burden were assessed using the survey questionnaire. Statistical Methods include Odds Ratio with 95% Confidence Interval**.**

Results: The proportion of those with symptoms of depression among diabetic patients was 56.4%. They were more likely to be women (OR (95% CI: 3.9 (1.9 - 8.0)), unemployed (OR (95% CI: 2.1 (1.03 - 4.2)) and diabetic before the age of 50 (OR (95% CI: 2.1 (1.05 - 4.2)) and were more likely not to practice preventive behaviours (OR (95% CI: 2.0 (1.0 - 4.0)) and medication adherence (OR (95% CI: 3.7 (1.8 - 7.6)).

Conclusion: There was an unexpectedly high proportion of those with symptoms of depression among diabetic patients, none of whom were previously diagnosed. Those who had symptoms of depression were more likely to be unemployed, women and early diabetics. Moreover, they were more likely not to practice preventive behaviours and medication adherence.

Introduction

As per the WHO figures, the burden associated with diabetes in South Asia is worsening, with the projected figure in India reaching 57.2 million by 2025.(1) Optimal glycaemic control demands careful and daily self-management, including eating a balanced diet, exercise and routine testing of glucose. To emphasise this, the American Diabetes Association releases standards of medical care annually.(2) Comprehensive therapy requires improvements in lifestyle, pharmacological regulation of hyperglycemia, hypertension & hyperlipidaemia and preventive care.(3-5) Complications attributed to diabetes are significant causes of morbidity and mortality. Psychological disorders can impair the capacity and willingness of a patient to control his or her diabetes.(6) The prevalence of depression among diabetes patients is rising quite rapidly. Depression is twice as frequent in a diabetic individual as compared with a matched control without diabetes.(7) Not only does depression affect mood but it also compromises functioning.(8) There is evidence of impaired glycaemic regulation, insufficient physical activity, higher obesity, and more diabetes related end organ dysfunction, as depression accompanies diabetes.(9-14) There is also proof that reduced adherence to oral anti diabetes medications is linked with depression among patients newly diagnosed with diabetes.(15)

A meta-analysis conducted among Type 2 diabetes mellitus patients in India reports a high prevalence of depression in the Indian diabetic population. The pooled prevalence of depression in the southern region (37.7%) was reported to be higher when compared to the northern region.(16)

Furthermore, studies in Kerala have revealed that a large percentage (74%) of diabetic patients have poor medication adherence and nearly 60% of the diabetic population was found to have uncontrolled glycaemic status. Also a study in 2015 showed that the mean HbA1c levels were higher in those diabetic patients who also suffered depression than those without depression.(17) Several research articles have shown that there probably is a bidirectional relationship of depression and glycaemic control. Therefore treatment of depression could reduce HbA1c levels.(17) Analysis has provided growing evidence that treatment of depression can help enhance the outcome of co-occurring disease treatment. However, studies of the relationship between depression and self-care of diabetes have been focused on smaller patient populations or have investigated fewer facets of diabetes treatment in primary care. Little is understood on how depression affects the diabetes treatment continuum, ranging from home-based behaviours (e.g.: nutrition, exercise, glucose monitoring) and medication adherence and commitment to preventive care facilities. (e.g.: monitoring HbA1c or retinal examinations).

This cross sectional study was done to identify the gaps in diabetes management among patients with unidentified depression. In order to help explain the association of depression with specific facets of self-care, medication adherence and preventive treatment we also estimated the risk of poor lifestyle behaviours in diabetic patients with depression compared to those without depression.

Methods

This cross-sectional study was conducted at a tertiary care teaching institute in Kerala, India. All adult patients with Type 2 Diabetes Mellitus who were on anti-diabetic medications for more than one year and presented to the endocrinology department as out - patients between January and March 2022 were included. However, patients with Type I Diabetes Mellitus (DM), End Stage Organ Dysfunction (those with stable Chronic Kidney Disease and not requiring Hemo-Dialysis were not excluded) and malignancies were excluded. Patients with restricted mobility and those on medication for depression or other psychiatric illness were also excluded.

Informed consent was obtained from all those who participated. Clearance from the Institutional Ethics Committee was obtained prior to starting the study.

Detailed interview based questionnaire in the local language was used to collect and record data regarding history of diabetes, glycaemic control, screening for diabetic retinopathy and nephropathy. Self-care was assessed using a validated tool consisting of 13 questions that address various domains of self-care such as diet, exercise, foot-care, glucose monitoring, medication adherence, handling episodes of hypoglycemia and proactively updating themselves on DM related information. A score more than 13 was considered to have good self-care.(18)

Depression was assessed using the Malayalam version of the Patient Health Questionnaire -9 (PHQ-9)(19) a validated questionnaire in Malayalam, the local language. The PHQ-9 total score ranges from 0-27 and severity is categorised as none or minimal if the score is 0-4; as mild if 5-9; moderate if 10-14; moderately severe if 15-19 and severe if 20 and above. Two co-investigators were given training to use PHQ-9. Their rating was validated against that of the principal investigators and found to be reliable. Patients classified as having depression on screening were counselled to seek help from a psychiatrist by referral. No management strategy was planned by the investigative team.

Self-monitoring of blood glucose charts was provided to all participants. Routine blood tests to assess glycaemic control, end organ functions, etc. were done for all patients. Medication adherence was assessed based on several questions regarding intake of medications, frequency of missing their medications, attitudes towards medication, regularity of refills etc.

Statistical Methods

All the statistical analyses were performed using the SAS software (version 9.4). Odds ratio with 95% Confidence Interval was calculated for each binary risk factor. Comparison of means was done using z test for means. A p-value <0.05 was considered to be statistically significant.

Results

Of the 140 patients included in this study, more than half, that is 79(56.4%) study subjects had symptoms of depression as per PHQ-9. Among them 37 (26.42%) had moderate or severe depression. See Figure 1

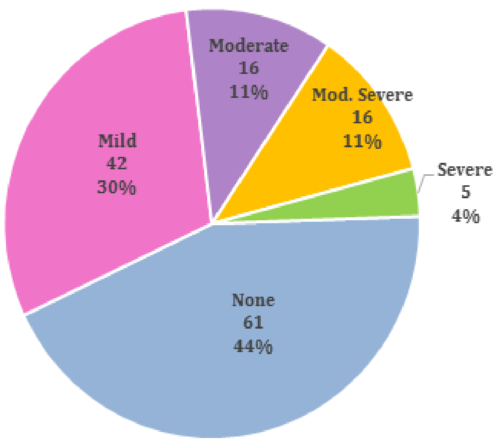

Figure 1: Distribution of Severity of Depression among Diabetics

As shown in Table 1, about half the study subjects were below the age of sixty (69 (49.3%)) and women (67 (47.9%)). A majority were unemployed (89 (63.6%)) and had only a school education (115 (82.1%)). The mean ± SD of the duration of diabetes was 11.9±8 8.9 years, that of HbA1c was 9.0%±1.9% and that of BMI was 26.8 ± 4.5.

Of these, two characteristics were significantly associated with being depressed. That is, those with symptoms of depression were 3.9 times more likely to be females and 2.1 times more likely to be unemployed subjects compared to those without symptoms of depression.

The distribution of comorbid conditions is also shown in Table 1. Almost all (86 (89.3%)) had more than one co-morbid condition. However, the number of comorbid conditions was not associated with symptoms of depression. The most common was Dyslipidaemia (98 (70.0%)) followed by Hypertension (87 (62.1%)) and the least common was Chronic liver Disease (5 (3.6%))

Table 1: Association of Socioeconomic and Comorbid Conditions with Symptoms of Depression among Diabetics

Characteristics	Total (N=140)	Depressed (n=79)	Normal (n=61)	OR (95% CI)
Socioeconomic				
Age <60 (Young)	69 (49.3%)	43 (54.4%)	26 (42.6%)	1.6 (0.8-3.2)
Female	67 (47.9%)	49 (62.0%)	18 (29.5%)	3.9 (1.9-8.0)
Unemployed	89 (63.6%)	56 (70.9%)	33 (54.1%)	2.1 (1.03-4.2)
School Education	115 (82.1%)	65 (82.3%)	50 (82.0%)	1.02 (0.4-2.4)
Comorbid Conditions				
Coronary Artery Disease (CAD)	30 (21.4%)	17 (21.5%)	13 (21.3%)	1.0 (0.4-2.2)
Chronic Kidney Disease (CKD)	17 (12.1%)	8 (10.1%)	9 (14.8%)	0.7 (0.2-1.8)
Chronic Liver Disease (CLD)	5 (3.6%)	3 (3.8%)	2 (3.3%)	1.2 (0.2-7.2)
Cerebrovascular Accident (CVA)	16 (11.4%)	4 (5.1%)	12 (19.7%)	0.2 (0.1-0.7)
Dyslipidaemia (DLP)	98 (70.0%)	54 (68.4%)	44 (72.1%)	0.8 (0.4-1.7)
Hypertension	87 (62.1%)	50 (63.3%)	37 (60.7%)	1.1 (0.6-2.2)
Obesity (>25 kg/m^2)	86 (61.4%)	48 (60.8%)	38 (62.3)	0.9 (0.5-1.9)
Others	6 (4.3%)	5 (6.3%)	1 (1.6%)	4.1 (0.5-35.6)

Table 2: Association of the Burden of Diabetes with Symptoms of Depression				
Characteristics	Total (N=140)	Depressed (n=79)	Normal (n=61)	OR (95% CI)
Disease Burden				
Age at DM < 50 years	85 (60.7%)	54 (68.4%)	31 (50.8%)	2.1 (1.05-4.2)
Uncontrolled DM (>7)#	112 (84.8%)	64 (87.7%)	48 (81.4%)	1.6 (0.6-4.2)
Duration of DM <10 years	62 (44.3%)	33 (41.8%)	29 (47.5%)	0.8 (0.4-1.6)
Diabetic Complications *	20 (14.6%)	6 (7.8%)	14 (23.3%)	0.3 (0.1-0.8)
Treatment				
OAD	120 (85.7%)	67 (84.8%)	53 (86.9%)	0.8 (0.3-2.2)
Insulin	67 (47.9%)	38 (48.1%)	29 (47.5%)	1.0 (0.5-2.0)
Both OAD & Insulin	52 (37.1%)	30 (38.0%)	22 (36.1%)	1.1 (0.5-2.2)
Health Behaviours				
Poor Self-Care	51 (36.4%)	34 (43.0%)	17 (27.9%)	2.0 (1.0-4.0)
Low Medication Adherence	58 (41.4%)	43 (54.4%)	15 (24.6%)	3.7 (1.8-7.6)

* Missing for 3 patients # Missing for 8 patients

As shown in Table 2 more than half (85 (60.7%)) were diagnosed with Diabetes before they turned 50 years of age, a majority 112 (80.0%) had uncontrolled diabetes with HbA1c more than 7. Less than half (62 (44.3%)) were recent diabetics of less than 10 years and diabetic complications were uncommon (20 (14.3%)). Those who had symptoms of depression were 2.1 times more likely to be diagnosed with DM before the age of 50 than those without symptoms of depression.

A majority (120 (85.7%)) of the subjects were on Oral Antidiabetic drugs (OAD) and almost half (67 (47.9%)) were on insulin and more than a third (52 (37.1%) were on both OAD and Insulin. The type of treatment wasn't associated with symptoms of depression. Based on the validated tool for self-care, those with symptoms of depression were 2 times more likely to have poor preventive practices of self-care and 3.7 times more likely to have poor medication adherence than those who did not have symptoms of depression.

As shown in Table 3, the most neglected preventive measures were awareness of complications in diabetes (92 (65.7%)) and awareness of the first aid measure in case of hypoglycemia (90 (64.3%)). More than half did not test the HbA1c levels every quarterly (79 (56.4%)) or proactively update themselves on diabetic care related information (71 (50.7%)). However none of these were associated with symptoms of depression. The association of depression with other aspects of self-care showed that those who had symptoms of depression had a 2.5 higher chance of not eating regularly and a 3.1 times higher chance of not exercising at least 30 minutes a day when compared to those who did not have symptoms of depression. No other preventive behaviour was associated with depression.

Table 3: Association of Symptoms of Depression with Self Care

Characteristics	Total (n=140)	Depressed (n=79)	Normal (n=61)	OR (95% CI)
Unaware of Glucose Monitor Use	32 (22.9%)	20 (25.3)	12 (19.7)	1.4 (0.6-3.1)
No Glucometer based change in behaviour	41 (29.3%)	25 (31.7)	16 (26.2)	1.3 (0.6-2.7)
Irregular Monitoring at home - fortnightly	60 (42.9%)	34 (43.0)	26 (42.6)	1.0 (0.5-2.0)
Irregular Monitoring of HbA1c - Quarterly	79 (56.4%)	46 (58.2)	33 (54.1)	1.2 (0.6-2.3)
Irregular Check-up	48 (34.3%)	31 (39.7)	17 (27.9)	1.7 (0.8-3.5)
Hesitate to discuss with Doctor	57 (40.7%)	35 (44.3)	22 (36.1)	1.4 (0.7-2.8)
Unaware of Complications	92 (65.7%)	50 (63.3)	42 (68.9)	0.8 (0.4-1.6)
Unaware of First aid for Hypoglycaemia	90 (64.3%)	46 (58.2)	44 (72.1)	0.5 (0.3-1.1)
Not Interested in Diabetic Care Information	71 (50.7%)	40 (50.6)	31 (51.7)	1.0 (0.5-1.9)
Not Taking Diabetic Diet	51 (36.4%)	31 (39.2)	20 (32.8	1.3 (0.7-2.7)
Don't Eat Regularly	36 (25.7%)	26 (32.9)	10 (16.4)	2.5 (1.1-5.7)
Don't Exercise Regularly (30 min Daily)	81 (57.9%)	55 (69.6)	26 (42.6)	3.1 (1.5-6.2)
Irregularity in time of Medication	21 (15.0%)	14 (17.7)	7 (11.5)	1.7 (0.6-4.4)

As shown in Table 4, the regularity with which each lifestyle behaviour was practiced was measured in days per week. The least was the number of days fatty food was taken per week. That was 1.2 + 1.8 days. The most was the number of days per week when at least one fruit was taken, which was 4.2 + 2.4. On the whole, consistent lifestyle practices were not carried out in this study population. Most of the beneficial practices were done less than 3 days a week. And they were not associated with depression.

Table 4: Association of Regularity of Lifestyle Practices with Symptoms of Depression among Diabetics

Characteristics	Total (n=140)	Depressed (n=79)	Normal (n=61)	p Value
Eat DM Diet per week (Days)	3.1 $\pm$ 2.9	3.3 $\pm$ 2.9	2.9 $\pm$ 2.9	0.4
Eat Fruits per Week (Days)	4.2 $\pm$ 2.4	4.0 $\pm$ 2.5	4.3 $\pm$ 2.2	0.5
Eat Fatty Food per Week (Days)	1.2 $\pm$ 1.8	1.1 $\pm$ 1.6	1.3 $\pm$ 2.0	0.4
Exercise 30 Min per week (Days)	2.4 $\pm$ 3.1	1.9 $\pm$ 2.9	2.9 $\pm$ 3.3	0.07
Monitor blood per week (Days)	2.4 $\pm$ 2.2	2.5 $\pm$ 2.1	2.4 $\pm$ 2.2	0.7
Check Feet per week (Days)	2.6 $\pm$ 2.9	3.1 $\pm$ 3.0	2.0 $\pm$ 2.7	0.04

Table 5: Association of Possible Cause of Medication Non-Adherence with Symptoms of Depression				
Characteristics	Total (n=140)	DEPRESSED (n=71)	NORMAL (n=69)	OR (95% CI)
Forgetful in General	50 (35.7%)	40 (50.6%)	10 (16.4%)	5.2 (2.3-11.7)
Difficulty remembering all medications	71 (50.7%)	48 (60.8%)	23 (37.7%)	2.6 (1.3- 5.1)
Forgot while Travelling	39 (27.9%)	24 (30.4%)	15 (24.6%)	1.3 (0.6-2.8)
Forgot Day before Hospital Visit	19 (13.6%)	10 (12.7%)	9 (14.8%)	0.8 (0.3-2.2)
Hassled with treatment plan	45 (32.1%)	34 (43.0%)	11 (18.0%)	3.4 (1.6-7.6)
Deliberately Stopped	39 (27.9%)	27 (34.2%)	12 (19.7%)	2.1 (1.0-4.6)
Felt Worse – So Stopped	19 (13.6%)	13 (16.5%)	6 (9.8%)	1.8 (0.6-5.1)
Felt Better -So stopped	27 (19.3%)	16 (20.3%)	11 (18.0%)	1.2 (0.5-2.7)

As shown in Table 5, overall, those with depression had a 3.7 times greater chance of poor medication adherence compared to the patients who did not show any depressive features. The most common reason given was they forgot. That is those who were depressed had 5.2 times higher odds of forgetting than those who didn't have symptoms of depression. However, forgetting during travel or forgetting the day before the hospital visit was equally distributed. Similarly, those who had symptoms of depression had 2.1 times higher odds of deliberately stopping their medication than those who didn't have the same. However, proportions of those stopping because they felt better or because they felt worse were equally distributed. Another common reason for poor adherence includes feeling hassled regarding the treatment plan with a 3.4 time higher chance among those having symptoms of depression than those without these symptoms.

Discussion

Diabetes is one of the most psychologically and behaviourally demanding medical illnesses. Although during its early stage, diabetes may remain largely asymptomatic, the threat of eventual development of long term complications, the progressively more complex treatment regimens employed to maintain glycaemic control and the life style modifications required to prevent some of the late complications, are always perceived as a burden by most patients and may predispose to depression. Patients often complain of feelings of fear, anger, resentment and devastation at the time of diagnosis and later. Moreover, people with co-morbid diabetes and depression also have significantly worse quality of life when compared to people with depression alone, diabetes alone, or non-depressed non-diabetic individuals.(20)

This cross sectional survey of diabetic patients in a tertiary care hospital clearly shows that a high proportion (56.4%) of diabetic patients are depressed. Most of whom were not aware that they were depressed. Other studies have shown only up to 13% and 22% of patients with type 1 and type 2 diabetes.(21)

It is still unclear which caused which. In fact, several studies have suggested a bi-directional association between depression and diabetes.(17) Biochemical changes due to depression could cause diabetes and vice versa. Alternatively, the burden of maintaining a disciplined life as required for diabetes could cause depression and vice versa. That is, depression could lead one to neglect to exercise and to eat regularly which could cause diabetes.

Irrespective of which came first, the depression or the diabetes, making lifestyle modifications by diabetic patients will greatly help in preventing the complications of diabetes and increase the quality of their life. However, those who have depression are less likely to adhere to medications, exercise regularly and take nutritious food.(22) Therefore, with the presence of comorbid depression in diabetes, the risk of poor self-care is bound to increase multiple times, as shown in this study, where those who were depressed were two times more likely not to take care of themselves and almost four times (3.7) more likely not to adhere to their medications compared to diabetics who were not depressed. Other studies have also shown that clinically depressed people with diabetes are more likely to have problems with medication adherence (23) without estimating how many times worse off they are.

In this study, women were almost 4 times more likely to be depressed than men. This could be attributed to the Indian culture of women having to silently take on the burden of financial insecurity and relationship issues with no way of expressing their concerns. Although substance abuse could have an additive effect on a patient with depression, it may not be the case in this study as women are not likely to indulge in such behaviours in our culture.

Furthermore, those unemployed were 2 times more likely to be depressed than those who were employed. The unemployed category included both retired and homemakers, apart from truly unemployed. Rather than attributing to financial difficulties, it may be the lack of purpose that is causing the depression, as most were elderly with family to take care of their financial needs.

The burden of dealing with a disease itself can cause depression. To see if the burden of diabetes is associated with depression, we excluded patients with comorbid conditions with excess burden such as Type I Diabetes Mellitus, End Stage Organ Dysfunction and malignancies. Those with restricted mobility and those on medication for depression or other psychiatric illness were also excluded. Of the five factors we studied, only those who began their diabetic journey before the age of 50 years were more likely (two times) to be depressed than those who were diagnosed later. The other four factors included type of treatment, duration of illness, diabetic complications and uncontrolled diabetes.

We used the Self-Care Scale (18) to examine 13 behaviours that would prevent the progression of diabetes. This included knowing how to use a glucometer, routine blood glucose monitoring, regular doctor's visits, regular and appropriate diet and exercise, awareness of complications of diabetes and what to do in case of hypoglycemia or changes in glucometer reading. Of these, those who were depressed were 2.5 times more likely to be irregular with their food intake and 3.1 times more likely to be irregular with exercise. All other behaviours were similar for both groups, hence not significantly different. Other studies have shown the same results too.(23)

A frequency of these behaviours showed that they were not practiced even three times a week on an average even if they claimed to practice them. This was true irrespective of their depression status.

We also explored if the cause of poor medication adherence changed with their depression status. We found that forgetfulness was 5 times more; believing that taking their medication is a hassle was more than 3 times more; remembering all the required medicines was more than 2.5 times more; and deliberately stopping their medications was 2 times among those who were depressed. Such a high risk of poor medication adherence may be due to the combined effect of cognitive decline which is known to be associated with uncontrolled diabetes (22) and depression.

Several studies have shown that dietary modifications can decrease HbA1c by 2.9%-age points within a 6-month period.(24) However, interventions that have addressed behavioural changes related to physical activity and dietary changes have each shown mixed results.(25) This is probably because moderators, such as depression alter the outcome. Therefore it is important to screen for depression and plan interventions that will address social factors that could reduce mild and moderate depression, such as social support and mental health counselling or social activities to prevent loneliness and cognitive decline, to name a few, and give medications for those with severe depression.

Limitations

This study did not look into possible reasons for the increased risk of depression among the unemployed. The socio-economic status of the patients was not explored. Although half the patients were over the age of 60 and probably retired from regular work, many of them may be engaged otherwise. This aspect was not looked into. The study is also limited by the fact that an intervention was not done for those found to have depression although they were advised to consult a specialist.

Conclusions

Depression among diabetics is a major issue that must be addressed professionally. Therefore it is important to implement effective screening programs for identifying depression among all diabetic patients and to initiate early intervention programs for high-risk patients.

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