Original Article

Proportion of depression and its determinants among type 2 diabetes mellitus patients in various tertiary care hospitals in Mangalore city of South India

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ABSTRACT

Background: Depression is found to be common among patients with diabetes and it is associated with poor outcomes in disease control. This study was carried out to find out the proportion and determinants associated with depression among patients with established type 2 diabetes mellitus (T2DM) in various tertiary care hospitals in Mangalore city of south India. **Materials and Methods:** This study was conducted in one government and three private tertiary care hospitals in Mangalore in December 2010. All consenting patients with confirmed diagnosis of T2DM were interviewed and screened for depression by administering the 9-item PRIME-MD Patient Health Questionnaire (PHQ-9). **Results:** Of the 230 T2DM patients, 119 (51.7%) were males. The mean age of all participants was 53.61 ± 10.7 years. The median duration of T2DM was found to be 12.1 ± 7.35 years. Among the participants, 71 (30.9%) met the criteria for moderate depression, 33 (14.3%) for severe depression, and the remaining 126 (54.8%) had no clinically significant depression. Only 26 (11.3%) patients were already aware that they were depressed, of whom just 3 had taken medical consultation. Among the risk factors, depression was found to be significantly associated with older age, female gender, low socioeconomic status, unskilled and retired employment status, having complications due to T2DM or comorbidities like hypertension and coronary artery disease, being overweight and being on insulin syringe injections. **Conclusion:** This study found a high proportion of depression among patients with T2DM. Therefore the care of individuals with diabetes mellitus (DM) should include the screening and possible treatment of depression in order to achieve and sustain treatment goals.

Key words: Depressive disorder, determinants, Diabetes Mellitus Type 2, health care facilities, risk factors

Introduction

Diabetes is a chronic disease which affects virtually every organ in the human system. The World Health Organization projected that 300 million people will suffer from diabetes by 2025. India has the second largest number of diabetic population in the world and it is expected that there will be 69.9 million diabetic populations in India by 2025.[1]

Depression is common among patients with type 2 diabetes mellitus (T2DM) and it is associated with worst diabetes outcomes.[2,3] Compared with patients with diabetes alone, patients with depression and diabetes have shown poor diligence in maintaining dietary restrictions and exercise, poorer self-management and poor medication adherence.[4,5] Thus they are more likely to suffer from uncontrolled hyperglycemia and complications, thereby resulting in increased health care use and costs, increased disability, lost productivity and higher mortality rates.[6,7]

Having diabetes and depression may also be associated with

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higher risk of suicide, with some reports of a 10-fold increased risk of suicide and suicidal ideation.[8,9] While depression may contribute to poor diabetes-related outcomes, diabetes and its complications may also contribute to poor depression outcomes.[10-12] Depression is still largely unrecognized by physicians managing patients with diabetes mellitus (DM).[13] It is estimated that only one-third of people with both DM and major depression are recognized and appropriately treated for both disorders.[14] The available data regarding the prevalence of depression in T2DM patients in India are limited. Therefore recognition of depression becomes important as cost-effective treatment is available resulting in improvement of diabetic care as well.[15,16] With this background we investigated the proportion of depression and its determinants among patients with T2DM attending various tertiary care hospitals i.e. those with multispecialty inpatient care in Mangalore, a coastal city in south India.

Materials and Methods

This cross-sectional study was done in three private hospitals namely Kasturba Medical College Hospital in Attavar, Kasturba Medical College Hospital near Ambedkar circle and Father Muller's Hospital and one government hospital namely Wenlock Hospital during the study period of 1 month in December 2010. Permission to do the study in these hospitals was obtained from the respective medical superintendent of each hospital. Later, all confirmed patients with T2DM visiting outpatient clinic and those admitted in wards were evaluated. The nature and purpose of the study was explained and full confidentiality assured. Written informed consent was subsequently obtained from patients who agreed to participate. The study protocol was approved by the institute's Ethics Committee.

Sample size of 230 was calculated by considering the prevalence of depression to be 41% among T2DM patients from a previously conducted study[17] and keeping the power of the study at 85% with an allowable error of 15%.

Data regarding demographic and socioeconomic factors, clinical details such as duration of illness, modality of treatment and presence of other comorbidities or complications due to DM were collected by interviewing the patient and supplemented from patient records. Socioeconomic status was assessed using modified Kuppuswamy's socioeconomic scale.[18]

Depression was assessed by administering the Kannada (local language) version of PRIME-MD Patient Health Questionnaire (PHQ-9).[19]

It has been validated in Indian population and is considered to be a reliable tool for diagnosis of depression.[20] The PHQ-9 is used to make provisional diagnosis of depressive disorder as well as it provides a severity score for depressive disorder. For the diagnosis of depression, scores of more than 15 were classified as severe depression requiring treatment, scores between 5 and 14 were classified as moderate depression and scores below 5 as patient without clinically significant depression. Therefore a patient obtaining a score of 5 or more was labeled to have depression. Each questionnaire took approximately 35-40 min to fill up.

A PHQ-9 score of 10 or greater has been found to have sensitivity for major depression of 88% and specificity of 88%.[21] The other scales used for diagnosis of depression like International Classification of Diseases - 10 (ICD-10) and Diagnostic and Statistical Manual of Mental Disorders IV (DSM IV) were found to have a sensitivity of 80.5% and 84.8% respectively and a specificity of 78.3% and 67.7%, respectively.[22]

Glycemic control was assessed by recording their HbA1c (non-diabetic reference range of 4.1-6.0%), which is reported to be a reliable indicator of blood glucose level for the last 3 months prior to testing.[23] To determine the glycemic status, HbA1c level was categorized as: a level less than 7% as good glycemic control, 7-8 as fair glycemic control and more than 8% as poor glycemic control.

Standing body height (to the nearest 0.1 cm) was measured with a commercial stadiometer. A digital scale with an accuracy of ±100 g was used to measure body weight. Body mass index (BMI) (kg/m^2) was calculated by dividing weight (in kilograms) by the square of height (in meters) as a measure of total adiposity.

Exclusion criteria

Those who had psychiatric problems before diagnosis of diabetes, family history of depression, patients aged below 15 years, type 1 diabetes mellitus patients and seriously ill patients were excluded from the study.

Descriptive statistics were used to summarize the data. Chi-square test and Fisher exact test were used to test the association for categorical variables. The significance level was set at 5%. Results were expressed as odds ratio (OR) and 95% confidence intervals (CI). Cronbach alpha was calculated to assess internal consistency of PHQ-9. All statistical analyses were carried out using Statistical Package for Social Sciences (SSPS) (Version 17.0, USA).

Results

Socio-demographic profile of the study population

is shown in Table 1. Out of the total 230 patients, 111 (48.3%) were inpatients. Majority (38.3%) of the participants were aged between 51 and 60 years. Mean age and standard deviation of all participants was 53.61 ± 10.7 years. Males (51.7%) were slightly more than females. Overall 74.3% of participants belonged to the middle socioeconomic class.

Screening for depression among participants was done using PHQ-9. Internal consistency of PHQ-9 was 0.81 indicating good consistency of this psychometric scale in the study population.

A total of 104 (45.2%) were found to suffer from depression, of which 71 (30.9%) had a moderate level of depression and the rest 33 (14.3%) had severe depression. Of these 104 people, majority (78 (75%)) were unaware about their depressive status. Of the 26 people who were already aware that they were depressed, only 3 (11.5%) had consulted a doctor for this condition. Average duration of time since the detection of diabetes was 12.10 ± 7.35 years.

The commonest comorbidity with DM was hypertension seen in more than half of the participants followed by coronary artery disease seen in about one-third of the participants. Among the complications, retinopathy (84 (36.5%)) followed by nephropathy (66 (28.7%)) were the commonest as shown in Table 2.

Depression was found to be associated with patients above the age of 60 years (P = 0.006), female gender (P = 0.0195), patients from lower socioeconomic status (P = 0.0003), retired patients and those in unskilled occupations (P = 0.031) [Table 3].

Eighty-four (36.5%) patients had complications or other comorbidities in addition to being diabetic. This group had significantly greater proportion of patients who were depressed (64 (76.2%)) compared to the other group of patients without complications or comorbidities where the proportion of depressed patients was 40 (27.4%) ($\chi^2 = 51.25$, $P < 0.001$).

Presence of complications like neuropathy, nephropathy, macrovascular complications, diabetic foot, amputations and sexual dysfunction was significantly associated with depression among the participants. Presence of comorbidities such as hypertension and coronary heart disease was also significantly associated with depression [Table 4].

Patients who were overweight were found to be significantly more depressed than patients of normal weight or underweight ($P < 0.001$) as shown in Table 5.

Table 1: Socio-demographic distribution of study population (*N*=230)

	No.	Percentage
Age group (years)		
15-30	6	2.6
31-40	14	6.1
41-50	60	26.1
51-60	88	38.3
61-70	50	21.7
>70	12	5.2
Gender		
Males	119	51.7
Females	111	48.3
Marital status		
Married	215	93.5
Unmarried	15	6.5
Educational status		
Illiterate	13	5.6
Primary school	28	12.2
Secondary school	123	53.5
College and above	66	28.7
Socioeconomic status		
Upper class	14	6.1
Middle class	171	74.3
Lower class	45	19.6
Occupational status		
Professional	14	7.4
Semi-professional	28	12.2
Skilled	77	33.5
Unskilled	41	17.8
Housewives	38	16.5
Retired	32	12.6

Table 2: Distribution of patients based on comorbidities* and complications due to diabetes mellitus (*N*=230)

Type of complication/comorbidity	No.	Percentage
Neuropathy	54	23.5
Nephropathy	66	28.7
Retinopathy	84	36.5
Microvascular complications	37	16.1
Hypertension*	121	52.6
Coronary artery disease*	74	32.2
Peripheral vascular complications	24	10.4
Macrovascular complications	42	18.3
Diabetic foot	61	26.5
Amputation(s)	6	2.6
Sexual dysfunction	63	27.4

*=Indicates co-morbid conditions

Patients receiving treatment in the form of insulin syringe injections were found to be more depressed compared to patients receiving insulin as pen devices or patients on blood sugar lowering drugs (P<0.001) as shown in Table 6. However, the level of sugar control was not found to be associated with depression among patients as shown in Table 7.

Discussion

Depression negatively affects quality of life, treatment outcome and medication adherence of patients with DM.

The prevalence of depression among the participants in the current study was found to be 45.2%. This was higher than the findings of other studies where it ranged from 33 to 41%.[17,24-27] However, studies done in Trivandrum and US found the prevalence of depression among T2DM patients to be slightly more than 70%.[28,29]

On the other hand, the prevalence of severe depression which was 14.3% in this study was lower than the observations made in the above studies where it ranged from 18 to 20%.[17,25,30]

A number of risk factors in the current study were found to be associated with depression. Patients aged above 60 years were found to be significantly more depressed than patients of other age groups. This could probably be because people of this age group are usually retired and thus would be totally dependent on their family members to meet their treatment expenses. However several other studies have reported no association between age and prevalence of depression among T2DM patients.[24,25,31-33]

It has been found in the present study that depression was more significant among female patients which has been supported by other studies.[11,24-27,33-37] It is known that major depression occurs twice as frequently in women than in men[35] and seems to be influenced by estrogen levels.[38] Another explanation toward women being more depressed could be the social role attributed to women (passivity, dependence and emotional expression) which possibly allows them to be more emotional and extroversive.[34]

No association was seen between marital status and depression in the present study which is similar to the observations made in a study done in Bahrain.[24] However, single respondents have shown higher depression score than their married counterparts in several other studies.[25,27,33,39]

Educational status was not found to be associated with depression in the present study which is consistent with the findings of few other studies.[17,30,39] But many other studies found significant association between the two.[11,25,40-42]

Table 3: Association of level of depression with the age, gender, marital status, socioeconomic status, education and occupation of participants

	Depressed (%)	Not depressed (%)	Total
Age			
15–30	0 (0)	6 (100)	6
31–40	3 (21.4)	11 (78.6)	14
41–50	21 (35)	39 (65)	60
51–60	43 (48.9)	45 (51.1)	88
61–70	30 (60)	20 (40)	50
>70	7 (58.3)	5 (41.7)	12
		χ^2=16.4, DF=5, *P*=0.006	
Gender			
Males	45 (37.8)	74 (62.2)	119
Females	59 (53.1)	52 (46.9)	111
		χ^2=5.454, *P*=0.0195	
Marital status			
Married	100 (46.5)	115 (53.5)	215
Unmarried	4 (26.7)	11 (73.3)	15
		χ^2=2.23, *P*=0.135	
Educational status			
Illiterate	8 (61.5)	5 (38.5)	13
Primary school	11 (39.3)	17 (60.7)	28
Secondary school	60 (48.8)	63 (51.2)	123
College and above	24 (36.4)	42 (63.6)	66
		χ^2=4.5, *P*=0.212	
Socioeconomic status			
Upper	2 (14.3)	12 (85.7)	14
Middle	71 (41.5)	100 (58.5)	171
Lower	31 (68.9)	14 (31.1)	45
		χ^2=16.53, *P*=0.0003	
Occupational status			
Professional	3 (21.4)	11 (78.6)	14
Semi-professional	10 (35.7)	18 (64.3)	28
Skilled	33 (42.9)	44 (57.1)	77
Unskilled	24 (58.5)	17 (41.4)	41
Housewives	14 (36.8)	24 (63.2)	38
Retired	20 (62.5)	12 (37.5)	32
		χ^2=12.263, *P*=0.031	
Total	104	126	230

Table 4: Association between depression and presence of complications or co-morbidities* among diabetic patients (*N*=230)

Complications/comorbidities	Depressed (%)	Not depressed (%)	Total	χ^2	*P* value	OR (CI)
Neuropathy	34 (63)	20 (37)	54	8.97	0.0027	2.57 (1.37-4.83)
Nephropathy	42 (63.6)	24 (36.4)	66	12.6723	0.0004	2.88 (1.59-5.21)
Retinopathy	45 (53.6)	39 (46.4)	84	3.728	0.0535	1.7 (0.99-2.92)
Microvascular complications	12 (32.4)	25 (67.6)	37	2.9096	0.089	0.53 (0.25-1.11)
Hypertension*	76 (62.8)	45 (37.2)	121	31.93	<0.001	4.89 (2.77-8.31)
Coronary artery disease*	43 (58.1)	31 (41.9)	74	7.318	0.0068	2.16 (1.23-3.79)
Peripheral vascular disease	8 (33.3)	16 (66.7)	24	1.647	0.199	0.56 (0.23-1.31)
Macrovascular complications	9 (21.4)	33 (78.6)	42	11.738	<0.001	0.27 (0.12-0.59)
Diabetic foot	42 (68.9)	19 (31.1)	61	17.891	<0.001	3.69 (1.97-6.9)
Amputation(s)	6 (100)	0 (0)	6		0.008	
Sexual dysfunction	47 (74.6)	16 (25.4)	63	29.139	<0.001	5.48 (2.86–10.43)

*Indicates co-morbid conditions, CI: Confidence intervals, OR: Odds ratio

Table 5: Association between depression and body mass index of diabetic patients (*n*=69)

Body mass index	With depression (%)	Without depression (%)	Total
Under weight	3 (27.3)	8 (72.7)	11
Normal weight	4 (10.5)	34 (89.5)	38
Over weight	13 (65)	7 (35)	20
Total	20	49	69

χ^2=18.908, *P*<0.001

Table 6: Association between depression in diabetic patients and the type of treatment

Type of treatment	With depression (%)	Without depression (%)	Total
Oral hypoglycemic drugs	31 (29.8)	73 (70.2)	104
Insulin pen device	3 (20)	12 (80)	15
Insulin syringe injection	24 (72.7)	9 (27.3)	33
Drugs and insulin pen device	7 (31.8)	15 (68.2)	22
Drugs and insulin syringe injection	39 (69.6)	17 (30.4)	56
Total	104	126	230

χ^2=38.980, *P*<0.001

Table 7: Association between glycemic control among patients and level of depression

Level of glycemic control	Depression present	Depression absent	Total
Good	25 (45.4)	30 (54.6)	55
Fair	64 (44.4)	80 (55.6)	144
Poor	15 (48.4)	16 (51.6)	31
Total	104	126	230

χ^2=0.167, *P*=0.922

In the present study, occupation was also found to be a risk factor. Depression was found to be more among patients who were doing unskilled work or among those who were retired. This could be probably due to financial burden imposed by the disease on these groups.

In a study done in Bangladesh housewives were found to suffer the most from severe depression, whereas retired persons were found to suffer the most from mild to moderate depression ($P < 0.05$). This study reported that overall depression was highest among housewives and lowest among businessmen.[25] However another study done in US reported no significant association between depression and the respondents' employment status ($P = 0.84$).[33]

Socioeconomic status in this study was found to be significantly associated with depression which is consistent with other study findings.[43-45] DM is a chronic physical disorder which cannot be cured but can only be controlled. It thus requires lifestyle alterations, lifelong medication and its adherence for its successful treatment. Therefore individuals with low earning power face the twin burdens of paying for health care, which is largely out-of-pocket expenditure in India and meeting the needs of their family.

In the study done in US no significant association was found between depression and monthly income which is in contrast with our observations.[33]

Presence of complications among the study participants was found to be significantly associated with depression in the present study which is similar to the observations made in a study done in Bangladesh.[25]

In a study done in Chandigarh it was observed that presence of neuropathy, nephropathy and diabetic foot disease was significantly associated with depression among diabetic patients.[17] The Bahrain-based study found presence of nephropathy and ischemic heart disease to be significantly associated with depression.[24] Few other studies observed nephropathy, neuropathy, macrovascular complications and sexual dysfunction to be significantly associated with depression.[31,39,46] These observations are in accordance with our findings. Conditions like peripheral vascular disease, microvascular complications and retinopathy were not associated with depression, which has been supported by the findings of the studies done in Bahrain and Greece.[24,26]

The present study also found the presence of other comorbidities like hypertension and coronary artery disease to be associated with depression which was also observed by Jose *et al.* in their study.[27] But in the study done in Trivandrum no association was reported between the presence of comorbidities or complications and the presence of depression among DM patients.[28]

Patients who were overweight were found to be significantly more depressed than patients of normal weight or underweight in the present study. A number of other studies also found statistically significant association between obesity (BMI ≥30 kg/m^2) and depression among T2DM patients.[6,17,24,34,47-51] Probable reason for this could be that obesity is often associated with a reduction in self-esteem and social and psychological problems. In few other studies however no association was established.[25,26,41,52]

It was also found in this study that patients receiving treatment in the form of insulin syringe injections were more depressed than other treatment groups. The Bahrain, Jordanian and US based studies reported insulin users to be significantly more likely to develop severe depression than users of oral anti-diabetic agents.[11,24,29] The Bangladesh-based study reported that treatment with oral anti-diabetic drugs and insulin together was associated

with mild to moderate depression while only insulin use was associated with severe depression ($P < 0.01$). This study also found the depression score to be higher in those who used syringe for insulin administration than among pen users ($P < 0.05$).[25] This could be because of the patients finding insulin as the most burdensome treatment compared to oral treatment.[53] Another reason for higher prevalence of depression among insulin-treated patients could be the pain of injection. Only the Chandigarh-based study reported no significant association of depression with insulin use among patients.[17]

Although control of blood sugar levels is the major factor in diabetes management, this criteria with respect to poor blood sugar control was not associated with depression among these patients. Rather factors like presence of complications and other comorbidities due to the disease were associated with depression among diabetic patients.

So even though one is having T2DM, it is not the tight or strict control of blood sugar that is going to influence depressive symptoms but the chronic complications of diabetes. In such a scenario what we are measuring as depression may also be psychological distress associated with managing their complications and comorbidities, which clinically can be called as adjustment disorder. Difference between depressive disorder and adjustment disorder is that for the latter, the main treatment is improving or removing the underlying risk factor or condition or stressor. Several other studies however, reported a significant association between the blood glucose level or HbA1c level and depression which was different from ours.[25-28,32,37,43,46]

Limitations

This study was conducted among patients coming to tertiary hospital setup and not on general population. Hence a possible selection bias cannot not be excluded as only the more concerned diabetic patients might be seeking specialized diabetes care.Cross-sectional design of this study could be a limitation as it prevents the researcher to infer about the causality between depression and diabetes. Recall bias cannot be totally eliminated but has been minimized by reviewing the documents and validating the data. Height and weight of majority of participants could not be recorded due to feasibility reasons.

Conclusion

This study has identified that a high proportion of T2DM patients (45.3%) suffer from depression. The study has also highlighted some of the factors associated with depression such as elderly age, female gender, low socioeconomic status, unskilled employment and retirement from occupation, complications due to DM, being overweight and being on insulin syringe injections. The findings of the current study should be replicated in order to formulate effective intervention programs. The care of individuals with diabetes mellitus should include the screening and possible treatment for depression in order to achieve and sustain treatment goals considering the fact that only one-fourth of patients with depression were actually aware about their depressive status in this study. Identifying depression early will further improve the quality of life of diabetes patients and also reduce overall treatment costs, which are generally unaffordable by most individuals with this disease in India. Clearly identifying diabetic patients with comorbid depression, knowledge about effective psychological support and improving access to effective treatments should be public health and research priority.

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