ORIGINAL ARTICLE

Discovering the link between diabetes, depression and cardiovascular disease

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Abstract: Objectives – We have conducted a study aimed at uncovering if depressed diabetic patients have a higher incidence of cardiovascular complications and have also evaluated the relationship between the presence of depression and glycemic control in these patients. **Methods –** A cross-sectional study was conducted on 1346 patients suffering from DM admitted to the Diabetes Department of the Emergency County Hospital Timișoara, between January and December 2012. **Results –** Out of the 1346 patients included in our study 8.5% have been also diagnosed with depression. Depression was found in 7.9% of patients with type 1 DM, while the prevalence of depression was 8.6% in the type 2 DM category. There was a statistic significance between diabetes mellitus and depression ($p < 0.05$). The mean value of HbA_{1c} was 9.2% in patients suffering from both DM and depression and 8.9% in diabetic patients only. Patients with DM and depression were able to achieve the <8% HbA_{1c} target in 29.31% of the cases, while those without depression in 32.59% of the cases. Our conclusions highlight the need for active screening for depression in diabetic patients due to the potential of this complication being overlooked and also in order to ensure that preventive action is taken.
Keywords: diabetes mellitus, depression, cardiovascular disease, life quality

Rezumat: Obiective – Am efectuat un studiu cu scopul de a descoperi dacă pacienții diabetici cu depresie au o incidență crescută de complicații cardiovasculare și am evaluat relația dintre prezența depresiei și controlul glicemic la acești pacienți. **Metode –** Am realizat un studiu cross-secțional pe 1346 de pacienți diabetici internați în Clinica de Diabet Zaharat a Spitalului Clinic Județean de Urgență Timișoara, în perioada ianuarie-decembrie 2012. **Rezultate –** Dintre cei 1346 de pacienți incluși în studiul nostru, 8,5% au fost diagnosticați cu depresie. Depresia s-a regăsit la 7,9% dintre pacienții cu DZ tip 1, în timp ce la pacienții cu DZ tip 2 a fost de 8,6%. Am descoperit o legătură statistic semnificativă între depresie și diabetul zaharat ($p < 0,05$). Valoarea medie a HbA_{1c} a fost de 9,2% la pacienții diabetici cu depresie, respectiv de 8,9% la pacienții doar diabetici. Pacienții diabetici și cu depresie au atins ținta de <8% a HbA_{1c} în 29,31% din cazuri, pe când cei fără depresie în 32,59% din cazuri. Concluziile noastre subliniază necesitatea unui screening activ pentru depresie la pacienții diabetici datorită potențialului omiterii acestei complicații și pentru a asigura acțiuni preventive în acest sens.
Cuvinte cheie: diabet zaharat, depresie, boală cardiovasculară, calitatea vieții

INTRODUCTION AND OBJECTIVES

Recent studies have brought to light the fact that people with diabetes mellitus (DM) have twice the risk compared to the general population of developing long-term symptoms of depression or anxiety. This however is a two way pathway because depression is associated with hyperglycemia and increased risk for diabetic complications while relief of depression improves glycemic control[1].

The odds for depression are significantly higher in women with DM rather than men, precisely due to the fact that depression overall is more likely to affect the female population[1]. However, a link between type 1 or 2 DM and depression was not established, possibly because many studies failed to fully characterize the depressed and non-depressed populations[1].

The complex relationship between depression and diabetes mellitus revolves around physical, physiologi-

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cal and genetic factors which until now remain uncertain. Depression may occur due to the hardships of advancing diabetes or to diabetes related abnormalities in neurohormonal function. On the other hand, depression doubles the risk of developing type 2 DM, independent of other risk factors. Moreover, in patients already diagnosed with type 2 DM, suffering from depression represents a risk factor for coronary heart disease and appears to accelerate the presentation of the ischemic heart disease[1]. It has long been recognized that mild forms of depression are found in up to two-thirds of patients hospitalized for acute myocardial infarction[2], with major depression being found in ~15% of cardiovascular disease patients[3].

The negative implications of depression in patients suffering from diabetes include worsening glycemic control, nonadherence to treatment, poor metabolic control and increased risk of vascular complications (diabetic retinopathy, neuropathy and macrovascular complications)[4]. Furthermore, depression can lead to increased disability, decreased quality of life, more somatic symptoms, increased healthcare costs and even increased mortality[4].

There are however, certain limitations to studies published so far due to the lack of an adequate control group or the use of self-report questionnaires to document depression. If comparing the prevalence of depression in the diabetic population using formal psychiatric criteria, Anderson and all found a 11.4% prevalence of depression, while using self-report scales the prevalence rose up to 31.0% according to the same study[1].

Having in view the potential for further inquiry and the need to establish an in depth association between diabetes mellitus, depression and cardiovascular disease, we have conducted a study aimed at uncovering if depressed diabetic patients have a higher incidence of cardiovascular complications. We have also evaluated the relationship between the presence of depression and glycemic control as well as the presence of depression in patients suffering from diabetes mellitus.

MATERIAL AND METHODS

We have conducted a cross-sectional study on 1346 patients suffering from DM admitted to the Diabetes Department of the Emergency County Hospital Timisoara over the period of a year, between January and December 2012. We have obtained the permission of the ethics committee of the Timisoara Emergency County Hospital and all the principles of the Helsinki Declaration were fulfilled. All relevant information was extracted from patient charts: demographic data, DM type and duration, DM treatment, weight status (using the body mass index), glycated hemoglobin (HbA_{1c}), presence of cardiovascular complications (coronary heart disease, stroke, peripheral artery disease and gangrene). Depression had been diagnosed by the hospital psychiatrist using the Hamilton Depression Scale. The presence or absence of diabetes mellitus was analyzed in connection to a number of variables such as HbA_{1c}, body mass index (BMI), diabetes duration, presence or absence of cardiovascular disease and type of antidiabetic medication (insulin or oral antidiabetic drugs). All the data gathered was statistically processed using descriptive statistics and chi-square and unpaired student's *t* test of EpiInfo software.

RESULTS

Out of the 1346 patients included in our study, more than half were males, 54%. The mean age was 60.6 years ±2.7 years SD and they had been diagnosed with diabetes mellitus for the past 11.6 ±8.8 years SD (Table 1).

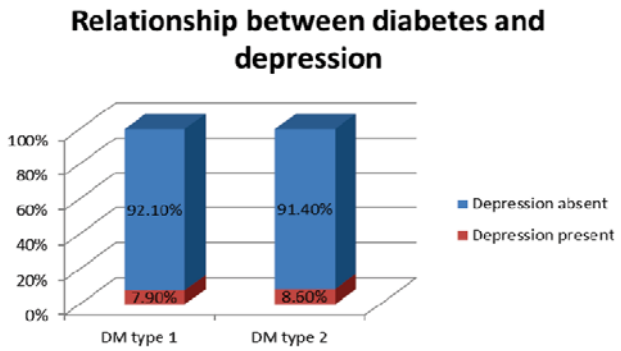
8.5% of the entire population studied had been also diagnosed with depression. However, when dividing the patients by the type of diabetes they suffered from, depression was found in 7.9% of patients with type 1 DM, while the prevalence of depression was 8.6% in the type 2 DM category (Figure 1A). In addition, two thirds of these patients had also anxiety besides depression. We have applied the HADS (Hospital Anxiety and Depression Scale) questionnaire to the patients diagnosed with depression in order to quantify the severity of their depression. We have matched equal groups of patients with DM type 1 and 2 and have applied the student *t* test uncovering a strong association between the type of DM and the severity of depression ($p < 0.01$) (Figure 1B).

Regarding glycemic control, the mean value of HbA_{1c} was 9.2% in patients suffering from both DM and depression, and 8.9% in diabetic patients only (Figure 2).

The prevalence of diabetic retinopathy was almost similar in patients diagnosed with depression

Table 1. Study population characteristics

Study group	1346 patients with DM
Mean age	60.6 ±2.7 years
Gender distribution	54% males 46% females
Diabetes duration	11.6 ±8.8 years



	HADS Score TD1DM	HADS Score TD2DM
Mean	17.23077	14.07692
Variance	1.858974	5.910256
Observations	13	13
Hypothesized Mean Difference	0	
df	19	
t Stat	4.079652	
P(T<=t) one-tail	0.000319	
t Critical one-tail	1.729133	
P(T<=t) two-tail	0.000639	
t Critical two-tail	2.093024	

Figure 1A. Relationship between diabetes and depression. **1B** Association between the type of diabetes and the severity of depression.

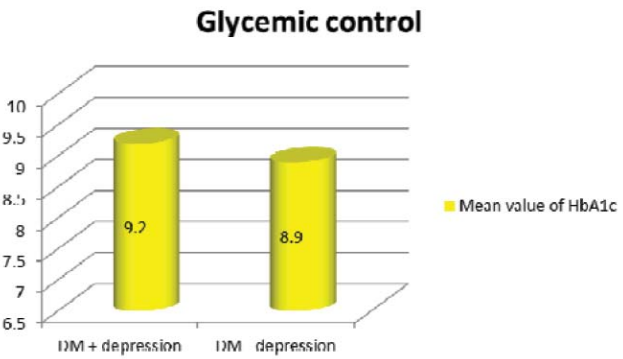


Figure 2. Mean value of HbA_{1c} in diabetic patients.

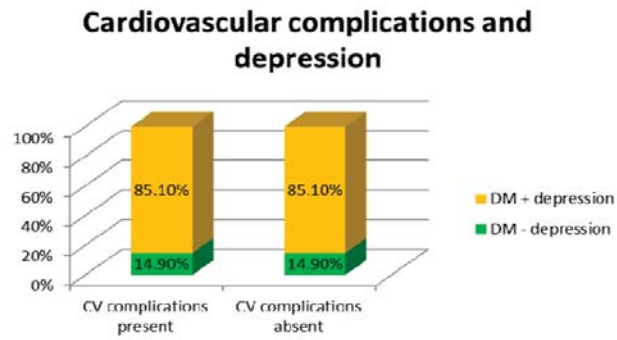


Figure 3. Relationship between cardiovascular complications and depression.

(28.95%) compared to patients without depression (30.5%). There was a slight difference regarding diabetic neuropathy, where 62.28% suffering from depression had also been diagnosed with this complication, while 60.69% of diabetic patients without depression had neuropathy. We were able to compare the weigh status and the presence or absence of depression in the population we studied. Thus, 23.42% of the patients with depression had normal weight, 34.23% were overweight, 21.62% had stage 1 obesity, 11.72% stage 2 obesity and 9.01% stage 3 obesity. Patients with DM and depression were able to achieve the <8% HbA_{1c} target in 29.31% of the cases, while those without depression were able to achieve this target in 32.59% of the cases. However, when set at <7% the target for HbA_{1c}, 15.52% of patients suffering from depression were able to reach this target and only 13.48% of those without depression. We were not able to find any difference in cardiovascular complications in diabetic patients with or without depression (Figure 3), as well as regarding the type of medication prescribed.

DISCUSSIONS

A growing body of research suggests that coexisting depression has a negative impact on patients suffering from diabetes. Previous studies have shown that depression is associated with poor glycemic control, increased risk of complications, decreased quality of life and increased health care utilization and costs[5]. There is considerable evidence that diabetes is a leading cause of coronary heart disease (CHD) and is connected to increased CHD mortality. Moreover, accumulating evidence points to the association of depression to increased CHD mortality[6]. The prevalence of depression in various heart conditions ranges from 15% to 20%[7]. According to data from the *World Health Organization,* by the year 2020 depression will be the second leading cause of disability in developed countries[8]. In the large INTERHEART study, the four most important factors contributing to presentation with acute coronary syndromes were a comprehensive lipid profile using Apolipoprotein B/Apolipoprotein A ratio, smoking, psychosocial factors (predominantly depression,

stress, life events and locus of control) and then diabetes. In the control group, the prevalence of major depression was about the same as in most non-cardiac populations (7%), but ~50% higher in the AMI group. However, this only contributed about 9% of the attributable risk, less than some of the other psychosocial factors[9]. Our results were not able to confirm these findings. These differences could possibly be explained by the fact that our cohort consisted mainly in a relatively young population (mean age 60.6 years old), who although having a high comorbidity burden in terms of diabetes complications had not yet developed major cardiovascular events.

Moreover, our sample consisted mostly in male patients (54%), and previous studies suggested that the contribution of depression to chronic disease outcomes might be stronger in women due to differential coping mechanisms[10].

The association between depression and diabetes is complex and there is evidence that the association is bidirectional. People with established diabetes have higher rates of depression than the general population, while depression has become established as a risk factor for diabetes. There are several mechanisms to explain this association from the "psychological stress" resulting from the diagnosis and treatment of the physical illness, through the metabolic derangement leading to mood disturbance to alterations in cytokines and stress hormones[11].

The underlying mechanisms between depression and diabetes complications are multifactorial, impairing the ability of patients for self-care as well as leading towards lack of physical activity and in turn to obesity[12].

Our study has several potential limitations. First of all, the diagnosis of depression was not based on the gold standard of a clinical interview, but data was taken from patient history, being highly likely that some patients had not been yet diagnosed because they were not actively searched for depression. This should be considered for further research. An active screening for depression in patients with diabetes is necessary due to the potential of this complication being overlooked in a diabetes centered department. Second of all, this was a retrospective study, thus patients were not interviewed but data was collected from patient files.

CONCLUSIONS

Our conclusions highlight the need for active screening for depression in diabetic patients due to the potential of this complication being overlooked and also in order to ensure that preventive action is taken. Further research will be necessary to disentangle causal relationships among depression, behavioral risk factors (adherence to medical regimens), diabetes complications, cardiovascular disease and mortality.

Comorbid depression and diabetes is often an under-recognized clinical problem and does not only impair the patient's quality of life but also adds difficulties to the self-management of diabetes[13].

It has been pointed out that depression in diabetes results in a high economic burden to society in terms of both direct and indirect costs[14,15]. It is therefore mandatory that careful attention should be rendered to this segment of the population in order to achieve an optimum management of depression in primary care settings which would then result in appreciable alleviation of suffering in those with diabetes and depression. More so, failure to manage depression may compromise the management of diabetes itself, which can have a severe impact on the quality of life itself.

Conflict of interests: none declared

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