

Psychological and Cognitive Profile of Hypertensive and Diabetic Patients

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Abstract: Chronic disorders such as hypertension and diabetes mellitus are often associated with depressive and anxiety symptoms, as well as cognitive decline. Once developed, psychological support is essential for improving the quality of life. This study is aimed at identifying impaired mental health in connection with these systemic metabolic disorders. A total of 34 patients were included in this cross-sectional study: 17 hypertensive individuals with a mean age of 59 ± 10 years, and 17 diabetic patients aged 54 ± 10 years. The following psychometric tests were used: Mini-Mental State Examination (MMSE), Beck Depression Inventory (BDI), Beck Anxiety Inventory (BAI), and self-reporting questionnaire (SRQ-20). A large number of patients with high blood pressure or diabetes was associated with mental health problems (82% or 65%, respectively; $p = 0.246$). Affective disorder, especially moderate to severe depression, was seen mainly in diabetic patients (76%), whereas hypertensive individuals had higher prevalence of anxiety (64%). There was no cognitive impairment in this middle-aged population. This study shows a high proportion of depression and anxiety symptoms in patients with hypertension or diabetes mellitus, reinforcing the importance of psychiatric support for appropriate control of these metabolic disorders.

Key Words: Anxiety, cognitive function, depression, diabetes, hypertension, mental health

(*J Nerv Ment Dis* 2015;203: 00–00)

There is evidence that high levels of systolic blood pressure and diastolic blood pressure are significantly related to cognitive decline, both in younger people as well as the elderly, and young adults with very high blood pressure have increased risks of dementia in old age (Ninomiya et al., 2011).

The association between systemic hypertension (SH), anxiety, and depression is not yet fully established in literature. However, neurofibrillary tangles and brain atrophy have been evidenced in autopsy of patients with this clinical condition, which can also be responsible for increased production of free radicals linked to the mechanisms of cerebrovascular damage (Reitz et al., 2007).

Hypertensive individuals are at risk of developing vascular dementia 3 times higher than the normotensive ones, and this proportion increases to 6 times with the presence of SH associated with diabetes mellitus (DM) (Posner et al., 2002). In diabetic patients, prevalence of anxiety and depression is greater than in the general population (Komsuoglu Celikyurt et al., 2014). Innumerable changes related to

DM can lead to mental disorders, including cerebral microvascular disease, the effects of hyperglycemia on the circuits and neural networks, hyperinsulinism, functional deficit of insulin in the brain, increased oxidative stress, and the characteristic DM dyslipidemia. The presence of cardiovascular disease, kidney failure, obesity, metabolic syndrome, and sedentary lifestyle can also contribute to mental disorders in diabetic patients (Strachan, 2011).

Memory loss is one of the most frequently reported cognitive deficits in diabetic patients, causing inappropriate behavior (Palta et al., 2014), which can interfere with self-care during treatment and promote the permanence of hyperglycemia. The hyperglycemic state can cause cognitive deficits leading to macrovascular and microvascular diseases in the brain, such as stroke and white matter lesions, associated with neurodegeneration markers, leading to atrophy of the medial lobe. Additionally, follow-up studies have shown that DM is associated with accelerated development of cerebral atrophy (Qiu et al., 2014). On the other hand, anxiety and depression may also contribute to weight gain (De Wit et al., 2010) and SH and/or DM development, which is one more reason for the counseling of hypertensive and diabetic patients.

This study aimed to describe the mental, cognitive decline as well as depression and anxiety states in hypertensive and diabetic patients treated at a center of secondary care of a city in Minas Gerais, candidates for participation in physical training program.

METHODS

Study Design

This is a descriptive, cross-sectional study developed as part of the “Global assessment of cardiovascular risk and mental status of patients assisted by Viçosa Hiperdia Center after exercise program,” a partnership between the Federal University of Viçosa with the Hiperdia Minas Program. The study was fully performed on the premises of Hiperdia Center in Viçosa, MG. The study was approved by the Ethics in Research Committee of the Federal University of Viçosa and registered in Brazil Platform with number 33979214.3.0000.5153 protocol number 832.149/2014.

Sample

The study included a total of 34 patients, 17 patients with type 2 DM and 17 patients with resistant SH, characterized by high blood pressure that remains above the levels considered ideal, despite the concomitant use of 3 different classes of antihypertensive drugs, one needing to be diuretic in their correct dosages (Daugherty et al., 2012).

All volunteers were eligible to participate in the supervised exercise program Hiperdia Center in Viçosa, MG, for the registration and monitoring of hypertensive and/or diabetic patients assisted by the Unified Health System that meet the SES Resolution no. 2606 of December 7, 2010, which set out the guiding criteria for Integrated Reference Centers Viva Vida and Hiperdia Minas. The following exclusion criteria were considered: nonparticipation in the supervised exercise

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ISSN: 0022-3018/15/20310-0000

DOI: 10.1097/NMD.0000000000000367

program Hiperdia Center in Viçosa, MG; type 1 diabetic patients, peripheral arterial disease patients, illicit drug users, congestive heart failure, and decompensated pulmonary disease, and symptomatic cardiac arrhythmia.

Data Collection

The evaluation of the mental state of the participants was performed by a psychiatrist with the following instruments: Mini-Mental State Examination (MMSE) (Folstein et al., 1975), the Beck Depression Inventory (BDI) (Aksoy et al., 2015), the Beck Anxiety Inventory (BAI) (Ay et al., 2014), and a self-reporting questionnaire (SRQ-20) (Giang et al., 2006). The researcher guided the patient to take into account the last week and the day that the psychiatric evaluation was performed.

The MMSE is composed of questions measuring functions such as temporal and spatial orientation, attention and calculation, recall or memory, and language. A minimum score of 20 points was considered for illiterate patients, 25 points for patients with 1 to 4 years of schooling; 26.5 points for 5 to 8 years, 28 points for 9 to 11 years, and 29 points for more than 11 years of schooling (Bertolucci et al., 1994; Brucki et al., 2003).

The BDI is a psychometric questionnaire of self-evaluation. The scale consists of 21 items including attitudes and symptoms with intensity ranging from zero to 3 and are intended to identify the presence of depressive indicators, considering various categories of symptoms such as: mood (sadness, loss of interest, crying, and mood fluctuation), vegetative or somatic (loss of weight, loss of appetite, sleep, and fatigue), cognitive (guilt, hopelessness, and suicidal thoughts), social (social withdrawal and inhibition), and physical symptoms (inhibition and agitation) (Beck et al., 1988). The participants who scored zero to 9 points were considered minimal depression; 10 to 16, mild depression; 17 to 29, moderate; and 30 to 63, severe (Aksoy et al., 2015).

The Beck Anxiety Inventory was used to assess the severity of symptoms of anxiety using a symptom scale organized in 21 items, ranging from nothing, slightly, moderately, and severely, shown in anxiety symptoms such as nervousness and tremors; and questions about palpitations, fear, feeling of suffocation and fainting, heat, numbness,

TABLE 1. Characteristics of the Sample of Hypertensive Diabetic Patients Assisted by Hiperdia in Viçosa, MG

	Total (n = 34)	Hypertensive Patients (n = 17)	Diabetic Patients (n = 17)	p
Age, years	56 ± 10	59 ± 10	54 ± 10	0.434 ^a
Men/Women	11/23	4/13	7/10	–
BMI				
Underweight	0	0	0	–
Ideal weight	4 (12%)	1 (6%)	3 (18%)	0.601 ^b
Overweight	11 (33%)	7 (41%)	4 (24%)	0.464 ^b
Obesity	19 (56%)	9 (53%)	10 (59%)	0.999 ^c
Education, years				
Illiterate	12 (35%)	6 (35%)	6 (35%)	0.999 ^c
0–3	9 (26%)	5 (29%)	4 (24%)	0.998 ^b
4–8	10 (29%)	5 (29%)	5 (29%)	0.999 ^c
8 or more	3 (9%)	1 (6%)	2 (12%)	0.999 ^b

^aStudent *t* test; data presented as mean ± SD.

^bFisher exact test; data presented as number of participants and percentage.

^cχ²-test; data presented as number of participants and percentage.

n indicates sample size; *p*, probability for the hypothesis tests.

TABLE 2. Psychometric Tests in the Hypertensive and Diabetic Groups

	Total (n = 34)	Hypertensive Group (n = 17)	Diabetic Group (n = 17)	p
Mini-Mental State Examination (MMSE)	24 ± 6	24 ± 3	25 ± 3	0.506
Beck Depression Inventory (BDI)	24 ± 12	24 ± 13	23 ± 12	0.770
Beck Anxiety Inventory (BAI)	21 ± 14	21 ± 13	19 ± 13	0.627

^aStudent *t* test; data presented as mean ± SD.

and others. We considered zero to 7 points minimal anxiety; 8 to 15, mild anxiety; 16 to 25, moderate; and 26 to 63, severe (Ay et al., 2014).

The SRQ-20 was used for tracking nonpsychotic mental disorders in the evaluation of mental suffering. The instrument consists of 20 questions, and the answers are binary (yes/no); the final score was obtained by adding the positive responses made in the test. Obtaining up to 6 positive responses led to no suspicion of mental disorder, and above 7 positive responses led to a mental disorder suspicion in relation to the last 30 days lived by the patient (Tajfard et al., 2014).

Statistical Analysis

The minimum size of the sample was defined using the coefficient of variation obtained in this study (25%), considering 15% of variation around the average, with a minimum number of 11 individuals each group. It was possible to verify statistical differences with a 5% level of significance. Initially, we used the descriptive statistics of the sample, obtaining the means and SDs. The Shapiro-Wilk normality test was used. Given that the data showed a normal behavior, a descriptive statistic was used to characterize the sample besides the independent *t* test for observing significance between the groups of hypertensive and diabetic patients, in addition to using the *t* test of a sample to measure the probability of the average score on the MMSE concerning the stipulated amount for that population. In addition, we used the χ² and the Fisher exact tests to test possible differences in anxiety and depression between the 2 groups. Pearson and Spearman correlation tests were used to verify the correlations between variables. We also promoted the percentage distribution between the response rates of depression and anxiety prevalence among hypertensive and diabetic patients. The significance level for the tests was 5%. The data were analyzed using the SPSS statistics 20 software.

RESULTS

Characteristics of the studied sample is delineated in Table 1. Of the 34 patients evaluated, there was a higher prevalence of women (68%) compared to male members. There were no significant differences between the groups for age, education, or for body mass index (BMI).

The values obtained with the MMSE showed that hypertensive and diabetic patients had a score consistent with the average education of the 2 groups (3 years), which is 25 points, so the population studied showed no cognitive decline considering the data obtained with the MMSE. There was also no difference in the scores achieved by the participants older than 60 years old (n = 13), where an average of 24 points has been reached.

Table 2 presents the mean and SD values obtained for each group according to the score of each questionnaire used. Significant differences in the scores of questionnaires were not observed.

TABLE 3. Degrees of Depression and Anxiety in Hypertensive and Diabetic Groups

Classification	Total (n = 34)	Hypertensive Group (n = 17)	Diabetic Group (n = 17)	p
Minimal depression	4 (12%)	2 (12%)	2 (12%)	0.999 ^a
Mild depression	6 (18%)	4 (24%)	2 (12%)	0.656 ^a
Moderate depression	12 (35%)	5 (29%)	7 (41%)	0.720 ^b
Severe depression	12 (35%)	6 (35%)	6 (35%)	0.999 ^b
Minimal anxiety	4 (11%)	2 (12%)	2 (12%)	0.999 ^a
Mild anxiety	11 (32%)	4 (24%)	7 (41%)	0.464 ^a
Moderate anxiety	10 (29%)	6 (35%)	4 (24%)	0.707 ^a
Severe anxiety	9 (26%)	5 (29%)	4 (24%)	0.893 ^a

^aχ² test; data presented as number of participants and percentage.

^bFisher exact test; data presented as number of participants and percentage.

The values observed in the BDI showed a prevalence of moderate depression for both the hypertensive group and for the diabetic group, with no significant differences between them. The scores ranged from 1 to 47 points, with 35% of the sample having severe depression according to the questionnaire and the modal value of 20 points. The most frequently reported data were complete loss of interest in sex and the report of waking up several hours earlier than accustomed and not going back to sleep. The same applies to the BAI, where the 2 groups were classified with a predominance of mild anxiety, which is the interval from 16 to 25 points, also with no significant difference. The scores ranged from 1 to 55 points, where 26% had severe anxiety; the modal value was 13 points. The most frequently reported scores were high degree of nervousness and fear of losing control. Table 3 shows the number of participants and their respective percentages according to the classification of depression and anxiety degrees, in total values and for each group.

According to the SRQ-20 questionnaire, approximately 74% of the participants were classified as having a mental illness suspicion. Of the hypertensive group, 82.3% had a mental disorder suspicion, whereas 64.7% of diabetic patients also had this suspicion, with no significant difference between the groups (*p* = 0.246).

Positive and significant correlations were observed between the scores obtained with the BDI and BAI (*r* = 0.86; *p* < 0.001), between BDI and SRQ-20 (*r* = 0.65; *p* < 0.001) and between SRQ-20 and BAI (*r* = 0.61; *p* < 0.001). There were no significant correlations between these parameters and age or BMI.

DISCUSSION

The main finding of this study was the moderate level of depression and anxiety in patients with SH and/or type 2 DM, besides a high number of patients, particularly hypertensive, with likely positive screening for a nonpsychotic mental disorder.

With regard to depression and anxiety found in the participants, it becomes difficult to infer if the presence of SH and/or diabetes may lead to this mental illness, or if the development of this condition during the life has worsened the development of these clinical conditions, that is, because individuals with angiogenic and depressive feelings are more likely to have a less healthy lifestyle (Tajfard et al., 2014). This fact can lead to carelessness with food and physical activity, being more likely to develop cardiovascular disease and diabetes. Kretchy et al. (2014) noted that 57% of hypertensive patients had some degree of anxiety when 400 hypertensive patients were studied, aged 18 to 70 years, 149 men and 251 women, 41.5% being elderly. In this study, when hypertensive patients classified with moderate to severe anxiety were

grouped, this number corresponded to 55% of the participants. With regard to depression, in the study of Kretchy et al. (2014), only 4% had the disorder, in contrast to the study presented here that adding patients classified with moderate and severe depression was observed, totaling to 70% of the sample.

One of the main harmful effects of depressive events is the intervention on medical treatment for control of the presented clinical conditions, thereby decreasing the effectiveness of the treatment, the monitoring of these patients in a mental health service (Krousel-Wood and Frohlich, 2010) being extremely important. Serafini et al. (2010), studying 240 patients with congestive heart failure and hypertension, with a mean age of 60 years, found that only 0.01% of the participants had psychiatric treatment. For that reason, physicians often do not detect mental disorders that may be influencing the disease.

Psychiatric evaluation is extremely important for these patients, and all the attention should be given to target the improvement of quality of life and control of the psychiatric disorder, for potential improvement and compliance to the treatment. Psychiatrists and physicians from other specialties should be encouraged to work together to approach and manage complex and chronic diseases such as hypertension (Serafini et al., 2010).

We noted that 76% of the diabetic participants were classified with moderate to severe depression. It is worth considering that the diabetic patient who has depression may have great difficulty performing glycemic control. Improper DM treatment can intensify the symptoms of depression. Nouwen et al. (2010), in their meta-analysis of 11 studies, found that type 2 diabetes patients are 24% more likely to develop depression than those who do not have the disease. Another meta-analysis performed by Knol et al. (2006), which included 9 studies, showed that individuals with depressive symptoms were 37% more likely to develop DM than individuals without these symptoms.

Regarding anxiety in diabetics, there was a high rate of moderate and severe anxiety in this study. Adding these 2 categories, we have 55% of the studied population with anxiety levels that require care. There is a lot of controversy among studies. Gois et al. (2012) found no relationship between anxiety symptoms and glycemic control in a sample of 273 patients with type 2 diabetes. Hall et al. (2009) observed that the anxious behavior was associated with a diagnosis of prediabetes in a sample of 204 patients with type 2 DM. During anxiety events, the body experiences a state of stress with increased cortisol levels, resulting in hyperglycemic effects, thus inducing a lower glycemic control by the diabetic patient.

Considering evidences that show a high level of anxiety among diabetic patients, it becomes possible to recommend daily physical activities that provide relaxation, as well as options such as yoga or meditation. Recreational activities can also be very interesting such as dance. Some studies showed that regular physical activity can be extremely beneficial in controlling anxiety (Hur et al., 2014; Kim et al., 2013; Yoshihara et al., 2014).

In relation to the obtained data found using the MMSE, cognitive impairment was not observed in the studied participants. This instrument was chosen for its high validity, reliability, and easy application and is recommended for use in the elderly despite being increasingly used in adults. Jabourian et al. (2014) used the MMSE in a population of 266 healthy adults ranging from 18 to 65 years, where he observed lower cognitive scores in individuals older than 50 years, unlike the study of Singh-Manoux et al. (2014), which used the same questionnaire in individuals aged 35 to 55 years, where no association between age and cognitive deficit was observed but other factors were observed, such as high levels of IL-6 cytokine. In the present study, there was no difference in the scores achieved on the MMSE between the elderly and adults. The same level of education presented between them could, in part, explain these findings. When hypertension and diabetes are associated in the same person, it increases the risk of cognitive loss by 6 times (Posner et al., 2002). Although 70.5% of the diabetics have

hypertension in the studied sample, a lower MMSE score was not found when compared with those who had only hypertension or diabetes.

Considering the nonpsychotic mental disorder evaluated by the SRQ-20, a high rate of patients at risk for mental distress, especially with hypertension, was observed. One explanation for this may be the association of noncommunicable diseases with mental suffering, such as the findings in patients with pulmonary arterial hypertension and thromboembolic pulmonary hypertension in the study of Harzheim et al. (2013), where mental disorders were observed in 22.8% of their 172 patients with a mean age of 56 years.

Furthermore, these disorders are also associated with polypharmacy (Coelho et al., 2009). After some years of intensive treatment with various medicines, changes in mood may occur. It is necessary to emphasize that all participants in the hypertensive group were taking 3 or more antihypertensive drugs per day. Unlike the BDI and the BAI, the SRQ-20 seeks to identify, more broadly, mental suffering that can be related to other mental disorders, not only depression and anxiety.

Because it is a questionnaire with ample capacity for screening of mental disorders, the SRQ-20 proposes compliance with a screening of depressive and anxiety symptoms, as well as the BAI and BDI, and other mental disorders, as this may be the explanation for the positive correlation between these 3 instruments shown in this study.

Another fact that deserves attention in this study is the high rates of obesity presented by volunteers (Table 1), which may have contributed to the findings related to depression and anxiety. Obesity associated with SH and DM can further maximize the depression and anxiety symptoms, which are already often present in these diseases. Several studies have indicated an association between obesity and depressive/anxiety symptoms (Guedes et al., 2013), and even a reduction of these disorders after surgery for weight reduction (Zwaan et al., 2011). However, further studies are needed for the actual verification of the importance of obesity in mental status of this population, since this study was unable to identify a significant correlation between BMI and the scores observed for anxiety and depression.

The high prevalence of obesity in this evaluated group reinforces the importance of educational activities, such as providing places for supervised safe exercises for this group. Exercise can promote significant changes in already debilitated health along with a balanced diet, helping to reduce the consumption of medications and improve quality of life (American College of Sports Medicine, 2013).

Study Limitations

Since it is a transversal study, there was no follow-up appointment with the patients. Therefore, it was unclear whether the displayed mental state was only transitory or actually part of the sample. There was also the use of tracking instruments only, which cannot serve as a definitive diagnosis. In addition, as one of the inclusion criteria for this study was participation in the exercise program of the Hiperdia Center, this fact led to a limited sample size, since not all diabetic and hypertensive patients assisted at the Center can perform the exercises, only those that are recommended by the physician after a rigorous evaluation.

CONCLUSION

This study showed a high percentage of depression and anxiety state in patients with resistant SH or type 2 DM, with higher rates in hypertensive patients. The prevalence of depression and anxiety observed is considered high and may lead to a compromise in compliance and maintaining good control of the underlying disease, an assumption also reinforced by mental suffering suspicion observed in most participants. However, cognitive impairment among participants was not found, taking into account the presented education. These symptoms should be carefully studied and evaluated, and findings support the importance of psychiatric and psychological treatments in patients with SH and

type 2 DM for an effective treatment of these diseases, consequently improving the quality of life of hypertensive and diabetic patients.

ACKNOWLEDGMENTS

This study was sponsored by the Foundation for Research Support of Minas Gerais (FAPEMIG, Brazil).

JCBM is a fellow of the National Productivity Council for Scientific and Technological Development (CNPq), Brazil. RBT is a fellow of the Coordination for the Improvement of Higher Level Education Personnel (CAPES), Brazil. This article is part of the Master's degree thesis of RBT (Federal University of Viçosa, Minas Gerais, Brazil).

DISCLOSURE

The authors declare no conflict of interest.

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