Analysis of clinical features and behavioral characteristics in T2DM comorbid emotional disorders: an investigation based on questionnaire and medical data

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Abstract

Background Diabetes is a serious threat to human health. Physical torture and financial burden bring mental burden and psychological pressure to diabetic patients. The situation of diabetes management is quite severe and the assessment of mood disorders was particularly important.

Methods A total of 60 diabetic patients were included into this study. Information of the study population was obtained through medical history and questionnaire survey. The participants were divided into two groups according to the results of emotional disorders assessment.

Results The comparison results of basic information between the two groups showed that differences of the proportion of female, diabetic nephropathy ratio and education background were statistically significant ($p = 0.001$, $p = 0.01$ and $p = 0.027$). Blood pressure of the comorbidity group was significant higher than that of control group (SBP: $p = 0.000$, DBP: $p = 0.005$). HDL, creatinine and 25-dihydroxyvitamin-D level were statistically significant ($p = 0.014$, $p = 0.011$ and $p = 0.011$). The results of questionnaire survey showed that there were statistically significant differences in sleep quality, PSQI, smoking habit and frequency of consuming fish between the two groups ($p = 0.000$, $p = 0.000$, $p = 0.032$ and $p = 0.000$). In cognitive function assessment, we found that the percentage of people with cognitive disorders and the score of cognitive function were significantly different between the two groups ($p = 0.000$ and $p = 0.000$).

Conclusions Gender, education, diabetic nephropathy, hypertension, low levels of vitamin D, diet structure, sleep disorders were associated with diabetic emotional disorders. Physicians should not focus solely on blood glucose variability, psychology and emotion of the patients also deserve attentions.

1. Introduction

Diabetes mellitus (DM) is a chronic metabolic disease which affects human health seriously ^[1]. In 2015, the prevalence of diabetes was approximate 0.9% and the rate of abnormal glucose tolerance was about 6.67% worldwide ^[2]. The survey results of international diabetes federation (IDF) showed that diabetes and its complications severely threaten the human health, the prevalence of urban people was higher than rural populations. Diabetic patient need Long-term medication and continuous blood glucose monitoring, which causes physical torture and financial burden to medical system, the spending on diabetes treatment increased by 12% in global healthcare system ^[3]. Chronic pain, strict control of diet and repeated drug treatment bring mental burden and psychological pressure to diabetic patients ^[4].

Despair, depression, anxiety are common negative emotions in type 2 diabetes. Some studies indicate that the prevalence of anxiety and cognitive impairment are significantly increased in diabetic patients ^[5-8]. Depressive symptoms are appeared in approximate 40% diabetes and the rate of depression in diabetes is up to 20%-30%. More serious consequences consist in diabetes accompanied with emotional disorder patients ^[9, 10]. An investigation including 328 T2DM was conducted by Liu's research group and

the results showed that the prevalence of anxiety disorders in patients with complications compared with simple diabetic patients without complications (48.76% VS. 24.33%)^[11]. It indicated that emotional disorders were associated with diabetic complications. Bogner et al. have suggested that the higher risk of death was found in diabetic patients combined with mood disorders^[12]. Professional advice from diabetes experts was that early identification of emotional disorders and multidisciplinary therapy could improve the prognosis of the disease, reduce the incidence of complications and even cut the death rate [13, 14].

Therefore, to assess the psychological condition of diabetic patients is beneficial for prompt medical attention and it has important clinical significance to regulate insulin and blood sugar effectively. Early detection of poor mental state and analysis the potential risk factors are helpful to improve the life quality of diabetic patients with depression or anxiety disorder.

2. Materials And Methods

2.1 Study population

A total of 60 T2DM, who were hospitalized in endocrinology department of Jiading District Central Hospital from June 2019 to October 2019, become the research subjects of this study. The diabetic patients with mood disorders were classified as comorbidity group and the other patients without emotional disorders were brought into control group. Finally, 30 mood disorders diabetic patients were into comorbidity group and 30 T2DM without emotional complications were into control group.

2.2 Inclusion and exclusion criteria

Inclusion criteria:

- i) T2DM was diagnosed according to the WHO diagnostic criteria in 2013.
- ii) Emotional disorder must be clearly diagnosed.
- iii) Enough basic information and clinical data should be provided.

Exclusion criteria:

- i) Patients with mental disorders cannot complete questionnaires and assessment scales.
- ii) Diabetic patients with severe acute complications (serious infection, ketoacidosis, hyperosmolar coma, diabetes foot), hepatic or renal insufficiency, heart deficiency, malignant tumor, malignant anemia, had surgery should be ruled out.
- iii) Patients receiving hormone therapy or antidepressant drug treatment were excluded.

2.3 Research methods and emotional disorders assessment

A questionnaire survey regarding the general information (such as age, gender, body mass index (BMI), smoking status, family history and other medical history materials), behaviors, life style and frequency of food consumption was conduct among the 60 enrolled participants. Meanwhile, the trained physicians assessed emotional disorders by a variety of scales. The self-rating anxiety scale (SAS) was used to evaluate the state of anxiety. There are 20 items in SAS, the score of each item (range: 1-4) was depending on the severity. The final score is equal to the total core of 20 items multiplied by 1.25 and the standard score greater than or equal to 50 indicate anxiety.

Depressive position was estimated using PHQ-9 scale (0-4: no depression, 5-9: minor depression, 10-14: moderate depression, 15-19: moderately severe major depression, 20-27: severe major depression). Cognitive disorder was recognized by mini mental status examination (MMSE), the total score of the scale is 30 points and the score greater than 27 points is considered healthy. All patients signed the medical informed consent and agreed to participate in this research. Meanwhile, this study was approved by our local ethics committee.

2.4 Biochemical examination

Venipuncture was used to obtain venous blood and the samples were freezed in -70°C refrigerator. HbA1c, serum cholesterol, HDL-cholesterol, LDL-cholesterol, triglyceride (TG), hydrocortisone, thyroid function index, blood calcium, blood phosphorus and other indicators were tested in the two groups. Serum biochemicals were measured by automatic biochemical analyzer (Roche D/P/ISE, Switzerland) and HbA1c was measured by high-performance liquid chromatography (HLC-723g7, Japan).

2.5 Statistical method

The software STATA version 12.0 (STATA Corp., College Station, Tex) was used to evaluate the collected data. Data consistent with the normal distribution were presented as mean $\pm$ standard deviation (Mean $\pm$ SD). The numeration data and categorical variables were compared by chi-square analysis or Fisher's exact test. Differences of continuous variables between the two groups were tested by Student's t-test. The p value less than 0.05 was considered statistically significant.

3. Results

3.1 General information and clinical parameters

Finally, 60 participants were enrolled in this study. The 30 mood disorders diabetic patients were into comorbidity group (mean age=56.1 [SD=17.21], sex ratio M/F=9/21) and 30 T2DM without emotional disorders were into control group (mean age=52.4 [SD=13.32], sex ratio M/F=16/14). The course of diabetes in comorbidity and control group were 8.92 (SD=10.16) and 8.53 (SD=7.95), respectively. There were no significant differences in age, medical history and blood glucose situation between the two groups ($P>0.05$). The basic information of the study population and analysis results were shown in Table 1. The analysis results showed that the proportion of female in comorbidity group was significant higher

than the ratio of control group ($p=0.001$). The diabetic nephropathy incidence of comorbidity group was 33.33%, which is significant higher than 6.67% of control group ($p=0.01$, Figure 1). The differences of education years between the two groups were statistically significant ($p=0.027$). Blood pressure of the comorbidity group was significant higher than that of control group (SBP: $p=0.000$, DBP: $p=0.005$).

The clinical characteristics of all the participants were shown in Table 2. Compared with control group, no difference in Hba1c, triglycerides, total cholesterol, LDL, hepatorenal function, thyroid function, cortisol level, serum calcium and phosphate levels was found in comorbidity group ($P>0.05$). The differences in HDL and creatinine were statistically significant ($p=0.014$ and $p=0.011$). The 25-dihydroxyvitamin-D level in diabetic patients with emotional disorders was significantly lower than those in control group ($p=0.011$).

Table 1 General information of the study population

	Comorbidity group (n=30)	Control group (n=30)	t/ χ^2	p
Gender (male/female)	9/21	16/14	11.28	0.001
Age	56.10±17.21	52.4±13.32	0.93	0.356
Education years	8.03±4.89	10.6±3.82	2.27	0.027
Systolic pressure	149.36±22.36	123.83±11.28	5.05	0.000
Diastolic pressure	84.86±11.09	76.73±6.98	2.97	0.005
Disease course	8.92±10.16	8.53±7.95	0.17	0.869
Family history of diabetes	11 (36.67%)	14 (46.67%)	0.07	0.796
Hypertension history	15 (50.00%)	12 (40.00%)	0.07	0.791
Coronary heart disease history	3 (10.00%)	4 (13.33%)	0.16	0.688
Diabetic nephropathy	10 (33.33%)	2 (6.67%)	6.67	0.010
Diabetic peripheral neuropathy	16 (53.33%)	10 (33.33%)	2.44	0.118
Diabetic retinopathy	13 (43.33%)	9 (30.00%)	1.15	0.284
Atherosclerosis or plaque	23 (70.67%)	20 (66.67%)	0.74	0.390

Figure 1 The proportion of diabetic complications in the two groups

Table 2 Clinical characteristics of the two groups

	Comorbidity group (n=30)	Control group (n=30)	t/ χ^2	p
Hba1c	8.86±2.32	9.62±2.70	-1.17	0.247
Triglycerides, mmol/L	1.58±0.71	1.99±1.31	-1.51	0.137
Total cholesterol, mmol/L	4.49±1.12	4.17±1.03	1.16	0.254
HDL, mmol/L	1.14±0.31	0.95±0.27	2.53	0.014
LDL, mmol/L	2.78±1.04	2.50±0.92	1.10	0.274
ALT	29.80±42.70	38.14±45.43	-0.73	0.467
AST	22.00±17.52	25.13±23.32	-0.59	0.559
Creatinine, μ mol/L	110.73±189.02	20.67±14.57	2.60	0.011
25-dihydroxyvitamin-D	13.72±6.19	18.38±7.44	-2.64	0.011
Serum calcium	2.34±0.13	2.36±0.13	-0.60	0.554
Serum phosphate	1.187±0.158	1.16±0.177	0.62	0.536
FT3	4.02±0.78	3.86±0.75	0.81	0.421
FT4	14.65±2.22	15.21±2.19	-0.98	0.329
TSH	2.22±1.57	1.98±1.47	0.61	0.54
TPO-Ab (+/-)	9/19	12/16	0.69	0.408
TG-Ab (+/-)	11/18	16/13	1.73	0.188
Cortisol (8:00 AM)	345.36±88.38	390.76±151.61	-1.42	0.162
Cortisol (16:00 PM)	217.61±97.88	214.83±89.16	0.12	0.909
Cortisol (24:00 PM)	143.64±98.16	148.93±101.64	-0.21	0.838

3.2 Comparison of sleep status and life behavior

In comorbidity group, people who have the habit of napping account for 66.67% , which is higher than 63.33% in control group, but the difference was not statistically significant ($p=0.175$). There were statistically significant differences in sleep quality and PSQI between the two groups ($p = 0.000$ and $p = 0.000$, Figure 2 and Figure 3). The results of behavioral questionnaires survey (Table 3) showed the

habits including drink, tea, dietary structure and exercise of the two group had no statistically significant difference ($p > 0.05$). Smoking habit and frequency of consuming fish were closely related to emotional disorders ($p=0.032$ and $p=0.000$). In cognitive function assessment, we found that the percentage of people with cognitive disorders and the score of cognitive function were significantly different between the two groups ($p = 0.000$ and $p=0.000$).

Table 3 The comparison of sleep quality and behavioral style

	Comorbidity group (n=30)	Control group (n=30)	t/ χ^2	p
Siesta habit (yes/no)	20/10	19/11	1.84	0.175
Pittsburgh Sleep Quality Index	12.26±4.45	5.03±2.68	7.62	0.000
Sleep quality				
Excellent sleep quality	2 (6.7%)	20 (66.7%)	-34.59	0.000
Good sleep quality	6 (20%)	9 (30%)		
Average sleep quality	14 (46.7%)	1 (3.3%)		
Poor sleep quality	8 (26.6%)	0 (0%)		
Cognitive disorder	12/30 (40.00%)	1/30 (3.33%)	-4.01	0.000
MMSE score	26.03±0.79	29.12±0.18	3.89	0.000
Smoke	7 (23.33%)	15 (50.00%)	4.59	0.032
Drink	5 (16.67%)	8 (26.67%)	0.88	0.347
Tea	10 (33.33%)	14 (46.67%)	1.11	0.292
Dietary habit				
Meat-based meal	13(43.33%)	22 (73.33%)	6.01	0.050
Meat pigment mix	8 (26.67%)	5 (16.67%)		
Plant-based diet	9 (30.00%)	3 (10.00%)		
Frequency of consuming fish	1.41±0.682	2.10±0.712	-3.83	0.000
Exercise	25 (83.33%)	26 (86.67%)	0.13	0.718

Figure 2 The distribution of sleep quality in the two groups

Figure 3 The Pittsburgh Sleep Quality Index (PSQI) in the two groups

4. Discussion

As one of the most common chronic diseases, diabetes is a serious threat to human health. Physical torture, financial burden, strict control of diet and repeated drug treatment bring mental burden and psychological pressure to diabetic patients^[15]. Some studies have shown that the prevalence of anxiety was approximate 32%, which is higher than 5% in general population. As well as the prevalence of depression was significantly higher in diabetes compared with normal persons (26.67%–29% VS. 4%–7%)^[11, 16]. The situation of diabetes prevention and control is quite severe, in addition, the assessment of mood disorders and psychological counseling are particularly important. Clinical epidemiological data show that the prevalence of metabolic syndrome in diabetic patients with mood disorders is significantly higher than that in the general population, it means that emotional disorders could affect the prevalence of ischemic cardiovascular disease and all-cause mortality in diabetic population^[9, 10]. Peyrot team's findings had confirmed that gender, race and marital status were clearly independent risk factors for emotional disorders in diabetic patients^[17]. Another investigation results from 160 T2DM showed that the depression proportion of female patients was higher than that of male. Our results suggested that the female patients were more likely to suffer from mood disorders ($p=0.001$), which was consistent with domestic and international research findings. The reason for the high rate of depression in female patients may be that the emotions of female are vulnerable and volatile, the female patients are more sensitive to somatic symptoms and pay more attentions to their own conditions.

The results of our study indicated that there was a relationship between education level and mood disorders, lower levels of education was found in diabetic patients with emotional disorders ($p=0.027$). Poorly educated diabetic patients barely comprehend the disease related problems and have limited self-regulating ability. Therefore, the psychological conditions of them declined seriously compared with well educated patients^[18]. The levels of 25-dihydroxyvitamin-D were significant different in the two group was also an important finding in our study ($p=0.011$). [Lang](#) et al.'s research showed that high levels of vitamin D were found to be associated with the low incidence of depression and a review results also suggested there was an important association between 25-dihydroxyvitamin-D levels and seasonal affective disorder (SAD)^[19, 20]. We hold the opinion that low levels of Vitamin D in diabetes with emotional disorders might be caused by less outdoor exercise and few light. Some research data indicated that mood disorders could lead to the increase in short and long term complications^[21, 22]. Our results found that hypertension and the ratio of diabetic nephropathy were all higher in comorbidity group compared with control group ($p=0.000$ and $p=0.010$). Our research results were consistent with those findings.

This study also found that sleep quality and life behavior were closely related to emotional disorders. Good sleep quality, health of dietary patterns and regular behaviors were considers as advantage factors, which could improve the depressive symptoms^[19]. Most of our findings were consistent with that, however, the results smoking habit was opposite. The cause might be that the ratio of female was high in comorbidity group and men were the main group of smokers.

Conclusions

We found that gender, education, diabetic nephropathy, hypertension, low levels of vitamin D, unreasonable diet structure, sleep disorders were associated with emotional disorders in diabetes. Physicians should not focus solely on blood glucose variability, the patient's psychology and emotion also deserve attentions. Early detection of poor mental state and analysis the potential risk factors are helpful to improve the life quality of diabetic patients.

Declarations

Competing Interests

The authors declare no potential conflicts of interest.

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Author Contributions

1. Yang and L.X. Suo were responsible for the conception and design. M. Liu and X.J. Wang drafted the initial manuscript and revising it critically for important intellectual content. M. Liu and W. Yang analyzed the data. Y. Tian, Q.W. Zhang, J.H. Zhang, Q.Y. Chen and J. Chen were responsible for data collection. All authors read and approved the final manuscript.

Ethics approval and consent to participate

This research was approved by Jiading District Central Hospital Affiliated Shanghai University of Medicine & Health Sciences.

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Figures

Figure 1

The proportion of diabetic complications in the two groups

Figure 2

The distribution of sleep quality in the two groups

Figure 3

The Pittsburgh Sleep Quality Index (PSQI) in the two groups