New Phenomenon

Levels of serum brain-derived neurotrophic factor in Type 2 diabetes mellitus patients with and without depressive symptoms

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Accumulating evidence has demonstrated that major depressive disorder (MDD) and Type 2 diabetes mellitus (T2DM) are two of the most prevalent and devastating diseases, and lead to considerable economic burden and loss of production labor. A substantial body of studies suggested that there is a strong link between depression and T2DM. For example, the prevalence of depression is increased significantly in patients with T2DM compared with those without diabetes [1]. In addition, depression appears to increase the prevalence of development of T2DM [2]. Hypotheses regarding the link between MDD and T2DM consist of physical and psychological factors. In spite of the evidence that depression is epidemiologically associated with T2DM, the cause of this correlation is still unclear.

Brain-derived neurotrophic factor (BDNF) is one of the neurotrophin families of growth factors and has an important impact on the survival and synaptic of neurons in the adult central nervous system [3]. In addition, both animal and clinical experiments showed that BDNF has important influence on the pathobiology of T2DM, because BDNF modulates the secretion and actions of insulin, leptin, ghrelin, various neurotransmitters and peptides, and pro-inflammatory cytokines related to energy homeostasis [4]. These findings suggested the possibility that T2DM may be associated with the serum BDNF level.

Furthermore, a strong association between BDNF and depression has been demonstrated in both clinical and animal studies. For instance, animal experiments have demonstrated that BDNF reduction was associated with depressive states, and clinical investigations revealed that BDNF was able to reverse depressive status [5]. BDNF may play an important role in the pathogenesis of MDD and, therefore, might be involved in the therapeutic actions of antidepressants [6]. Additionally, the serum BDNF levels in depressed patients were lower than those in normal controls [7]. The genotype Met of the Val66Met polymorphism of the BDNF gene was found to be positively associated with depressive disorder, which suggested that BDNF genotyping may contribute to depression, because BDNF gene Val66-Met polymorphism plays an important role in the BDNF expression and/or activity [8]. Lower plasma concentrations of BDNF were found in depressive patients, and BDNF gene polymorphisms were found to be associated with depression [9]. Also, the BDNF levels were found to decrease in a community population with depressive symptoms [10].

Thus, depression/depressive symptom is one of the most frequent neuropsychiatric comorbidities of T2DM. Depression in T2DM is related to detrimental outcomes, such as poorer quality of life, greater disability in activities of daily living, and a burden in caregivers. However, few studies have explored whether there is significant difference in BDNF between T2DM with depressive symptoms and T2DM without depressive symptoms, and the clinical characteristics between the two groups.

In the present study, we examined the difference for Beck Depression Inventory (BDI) [11] score, serum BDNF levels, and biomarkers of glucose metabolism in T2DM patients with and without depressive symptoms, as well as in healthy controls. Table 1 shows that there was significant difference in BDI scores (P < 0.001) and duration of diabetes (P = 0.036) between the T2DM patients with and without depressive symptoms. The duration of diabetes in patients with depressive symptoms (8.51 ± 5.50 years) was longer than that in patients without depressive symptoms (4.78 ± 4.57 years). Additionally, there was no significant difference in fasting blood glucose (FBG), total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL), hemoglobin A1c (HbA1c), and BDNF between the T2DM patients with and without depressive symptoms.

Table 1 also shows that the mean BDNF level in the T2DM patients with depressive symptoms (22.25 ± 5.69 ng/ml) was significantly lower than that in healthy controls (33.08 ± 14.47 ng/ml) (P < 0.01), and the mean BDNF level in the T2DM patients without depressive symptoms (21.77 ± 7.61 ng/ml) was significantly lower than that in healthy controls (33.08 ± 14.47 ng/ml) (P < 0.01). No significant difference was found for age in the three groups. There was significant
difference in FBG among the T2DM patients with and without depressive symptoms, and normal controls.

The results of this study showed that the serum BDNF levels in Chinese T2DM patients with and without depressive symptoms were lower than those in normal controls respectively, and there was no significant difference in serum BDNF levels between Chinese T2DM patients with and without depressive symptoms. However, the duration of diabetes for the patients with depressive symptoms was longer than that in T2DM patients with depressive symptoms after controlling for age. These findings suggested that T2DM patients, with or without depressive symptoms, have lower serum BDNF levels, suggesting that BDNF is influenced by T2DM. Furthermore, our results also showed longer duration of diabetes, higher prevalence of depressive symptoms in patients with T2DM, which suggested that depressive symptoms in patients with T2DM may increase as the duration of T2DM increases.

An inverse correlation between serum BDNF levels and duration of diabetes has been demonstrated [4]. Another research showed higher serum BDNF levels in newly diagnosed female patients with T2DM [12]. The lower serum BDNF levels were found in non-obese young subjects with low insulin sensitivity [13]. These findings suggested that the duration of diabetes may influence the BDNF levels.

In conclusion, the serum BDNF level was lower in Chinese T2DM patients with or without depressive symptoms than that in healthy controls. These results suggested that diabetes and depressive symptoms both affect the serum BDNF level. The duration of diabetes may increase the prevalence of depressive symptoms in the patients with T2DM.

Funding

This work was supported by a grant from the China Postdoctoral Scientific Grant (No. 2014M550223).

References


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Table 1. Basic characteristics of T2DM patients with and without depressive symptoms, and normal controls

<table>
<thead>
<tr>
<th></th>
<th>Patients without depressive symptoms (n = 19)</th>
<th>Patients with depressive symptoms (n = 20)</th>
<th>Normal controls (n = 30)</th>
<th>F</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>53.42 ± 7.41</td>
<td>56.75 ± 7.99</td>
<td>57.00 ± 7.79</td>
<td>0.144</td>
<td>0.866</td>
</tr>
<tr>
<td>BDI</td>
<td>2.64 ± 0.96</td>
<td>12.10 ± 4.98</td>
<td>–</td>
<td>–</td>
<td>0.0001**</td>
</tr>
<tr>
<td>HDL (mM)</td>
<td>1.09 ± 0.58</td>
<td>1.01 ± 0.25</td>
<td>–</td>
<td>–</td>
<td>0.571</td>
</tr>
<tr>
<td>LDL (mM)</td>
<td>2.57 ± 0.97</td>
<td>2.55 ± 0.94</td>
<td>–</td>
<td>–</td>
<td>0.941</td>
</tr>
<tr>
<td>HbA1c</td>
<td>8.81 ± 2.73</td>
<td>9.20 ± 3.07</td>
<td>–</td>
<td>–</td>
<td>0.682</td>
</tr>
<tr>
<td>FBG (mM)</td>
<td>8.30 ± 3.13</td>
<td>8.24 ± 3.59</td>
<td>4.82 ± 0.83</td>
<td>15.63</td>
<td>0.0001**</td>
</tr>
<tr>
<td>TC (mM)</td>
<td>4.53 ± 1.25</td>
<td>4.81 ± 1.22</td>
<td>4.91 ± 0.67</td>
<td>4.20</td>
<td>0.019*</td>
</tr>
<tr>
<td>TG (mM)</td>
<td>1.90 ± 1.51</td>
<td>2.42 ± 2.78</td>
<td>1.61 ± 0.90</td>
<td>1.17</td>
<td>0.316</td>
</tr>
<tr>
<td>BDNF (ng/ml)</td>
<td>21.77 ± 5.71</td>
<td>22.25 ± 5.69</td>
<td>33.08 ± 14.47</td>
<td>8.52</td>
<td>0.001**</td>
</tr>
<tr>
<td>Duration of diabetes</td>
<td>4.78 ± 4.57</td>
<td>8.51 ± 5.50</td>
<td>–</td>
<td>–</td>
<td>0.036*</td>
</tr>
</tbody>
</table>

FBG, fasting blood glucose; TC, total cholesterol; TG, triglycerides.

Data are expressed as the mean ± SD. *P < 0.05; **P < 0.01.