Correlation of anxiety state with blood glucose control, microinflammation and oxidative stress in patients with type 2 diabetes mellitus

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ABSTRACT

Objective: To study the correlation of anxiety state with blood glucose control, microinflammation and oxidative stress in patients with type 2 diabetes mellitus. Methods: A total of 138 patients with type 2 diabetes mellitus were divided into the non-anxiety group (n=43) (SAS score < 50 points), mild-to-moderate anxiety group (n=71) (SAS score 50-69 points) and severe anxiety group (n=24) (SAS score ≥ 70 points) according to the self-rating anxiety scale (SAS) score. The differences in levels of glucose metabolism indexes, microinflammation indexes and oxidative stress indexes were compared among the three groups. Results: Peripheral blood FPG, P2hPG, HOMA-IR, CRP, ASAA, IL-6, MDA and ROS levels of mild-to-moderate anxiety group and severe anxiety group were higher than those of non-anxiety group while CAT and GSH-Px contents were lower than those of non-anxiety group; peripheral blood FPG, P2hPG, HOMA-IR, CRP, ASAA, IL-6, MDA and ROS levels of severe anxiety group were higher than those of mild-to-moderate anxiety group while CAT and GSH-Px contents were lower than those of mild-to-moderate anxiety group. Conclusion: The increase of anxiety in patients with type 2 diabetes mellitus is a direct factor leading to the abnormal glucose metabolism as well as the aggravation of microinflammatory state and oxidative stress state.

1. Introduction

Anxiety is one of the important complications in patients with type 2 diabetes, statistical studies have shown that the incidence is up to 11-60%, and severe anxiety is thought to be the direct factor leading to poor metabolic control and disease outcome. At present, the treatment of type 2 diabetes mellitus mainly focuses on the choice of hypoglycemic drugs, diet and exercise control, etc., but pays less attention to the patients’ emotional state and intervention. The direct link between anxiety and the condition of diabetic patients is not yet conclusive and is also one of the reasons why clinical psychological intervention of such patients is difficult to be implemented. In the study, the existence and severity of anxiety were used as the grouping criteria to judge the influence of anxiety on the glucose metabolism, microinflammation and oxidative stress in patients with type 2 diabetes mellitus, now reported as follows.

2. Information and methods

2.1 General information

A total of 138 patients with type 2 diabetes mellitus who were treated in the hospital between September 2015 and February 2017 were selected as research subjects, the anxiety state was evaluated by self-rating anxiety scale (SAS), and the SAS score was referred to divide the patients into the non-anxiety group (n=43) (SAS score < 50 points), mild-to-moderate anxiety group (n=71) (SAS score 50-69 points) and severe anxiety group (n=24) (SAS score ≥ 70 points).
points). Non-anxiety group included 25 men and 18 women that were 49-71 years old; mild-to-moderate anxiety group included 38 men and 33 women that were 45-74 years old; severe anxiety group included 14 men and 10 women that were 47-75 years old. The differences in the gender and age distribution were not significant among the three groups, the follow-up data were comparable, and the hospital ethics committee approved the study.

2.2 Inclusion and exclusion criteria

Inclusion criteria: (1) meeting the diagnostic criteria for clinical type 2 diabetes mellitus; (2) regularly accepting drug therapy for ≥6 months; (3) cooperating with the whole examination and with complete clinical data. Exclusion criteria: (1) with basic anxiety or anxiety disorders prior to diagnosis of type 2 diabetes; (2) combined with inflammatory diseases of other tissue organs; (3) combined with hyperthyroidism, thyroidism, pheochromocytoma and other endocrine diseases; (4) combined with basic severe heart, liver and kidney injury.

2.3 Glucose metabolism indexes

Immediately after admission, 1.0 mL of morning (around 7:00 am) fasting cubital venous blood and 1.0 mL of 2 h venous blood were extracted from two groups of patients, and automatic biochemical analyzer (Japanese Toshiba Medical Systems Corporation, model TBA-120FR) was used to determine glucose metabolism indexes levels, including fasting plasma glucose (FPG), 2 h postprandial blood glucose (P2hPG) and insulin resistance index (HOMA-IR).

2.4 Microinflammation and oxidative stress indexes

Immediately after admission, peripheral blood was obtained from two groups of patients at the same time point, anti-coagulated and centrifuged at low speed to get the upper serum, which was frozen in -80 ℃ environment. Enzyme linked immunosorbent assay (ELISA) was used to determine serum microinflammation indexes, including C-reactive protein (CRP), acute phase serum amyloid A (ASAA) and interleukin-6 (IL-6). ELISA was used to determine the contents of oxidative stress indexes in serum, including malonaldehyde (MDA), reactive oxygen species (ROS), catalase (CAT) and glutathione peroxidase (GSH-Px).

2.5 Statistical processing

Statistical software was SPSS 24.0. Glucose metabolism, microinflammation and oxidative stress indexes belonged to measurement data and were in terms of mean ± standard deviation, comparison among groups was by variance analysis and pair-wise comparison between two groups was by LSD. Statistic P≤0.05 indicated statistical significance in differences.

3. Results

3.1 Glucose metabolism indexes

Comparison of peripheral blood glucose metabolism indexes FPG (mmol/L), P2hPG (mmol/L) and HOMA-IR levels among three groups of patients was as follows: peripheral blood FPG, P2hPG and HOMA-IR levels of mild-to-moderate anxiety group and severe anxiety group were significantly higher than those of non-anxiety group, and peripheral blood FPG, P2hPG and HOMA-IR levels of severe anxiety group were significantly higher than those of mild-to-moderate anxiety group, shown in Table 1.

Table 1. Comparison of peripheral blood glucose metabolism index levels among groups.

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>FPG</th>
<th>P2hPG</th>
<th>HOMA-IR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-anxiety group</td>
<td>43</td>
<td>6.28±0.73</td>
<td>8.74±0.52</td>
<td>2.17±0.25</td>
</tr>
<tr>
<td>Mild-to-moderate anxiety</td>
<td>71</td>
<td>7.19±0.84</td>
<td>9.63±1.43</td>
<td>2.98±0.36</td>
</tr>
<tr>
<td>Severe anxiety group</td>
<td>24</td>
<td>9.84±1.67</td>
<td>12.61±1.58</td>
<td>3.74±0.45</td>
</tr>
<tr>
<td>F</td>
<td>14.387</td>
<td>11.526</td>
<td>8.293</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

Note: compared with indexes of non-anxiety group, *P<0.05; compared with indexes of mild-to-moderate anxiety group, #P<0.05.

3.2 Microinflammation indexes

Comparison of serum microinflammation indexes CRP (mg/L), ASAA (μg/L) and IL-6 (pg/mL) contents among three groups of patients was as follows: serum CRP, ASAA and IL-6 contents of mild-to-moderate anxiety group and severe anxiety group were significantly higher than those of non-anxiety group; serum CRP, ASAA and IL-6 contents of severe anxiety group were significantly higher than those of mid-to-moderate anxiety group, shown in Table 2.

Table 2. Comparison of serum microinflammation index contents among groups.

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>CRP</th>
<th>ASAA</th>
<th>IL-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-anxiety group</td>
<td>43</td>
<td>1.09±0.17</td>
<td>10.38±1.74</td>
<td>5.82±0.74</td>
</tr>
<tr>
<td>Mild-to-moderate anxiety</td>
<td>71</td>
<td>3.42±0.48</td>
<td>14.29±2.11</td>
<td>7.11±0.85</td>
</tr>
<tr>
<td>Severe anxiety group</td>
<td>24</td>
<td>5.17±0.64</td>
<td>19.63±2.46</td>
<td>10.64±1.92</td>
</tr>
<tr>
<td>F</td>
<td>9.209</td>
<td>13.276</td>
<td>11.739</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

Note: compared with indexes of non-anxiety group, *P<0.05; compared with indexes of mild-to-moderate anxiety group, #P<0.05.

3.3 Oxidative stress indexes

Comparison of serum oxidative stress indexes MDA (μmol/L), ROS (μmol/L), CAT (U/mL) and GSH-Px (pg/mL) contents among three groups of patients was as follows: serum MDA and ROS contents of mild-to-moderate anxiety group and severe anxiety group were significantly higher than those of non-anxiety group while CAT and GSH-Px were significantly lower than those of non-anxiety group.
GSH-Px contents were significantly lower than those of non-anxiety group; serum MDA and ROS contents of severe anxiety group were significantly higher than those of mid-to-moderate anxiety group while CAT and GSH-Px contents were significantly lower than those of mid-to-moderate anxiety group, shown in Table 3.

4. Discussion

Middle-aged and elderly people are the main affected population of type 2 diabetes, and some patients do not have clear understanding about the disease causes, treatment outcome and so on, which directly leads to conflict or panic, and even anxiety in severe cases, and is not conducive to the realization of the clinical treatment effect and are the main substances that cause the vascular endothelial injury in diabetic patients mellitus[6,7]. In this study, the SAS score was referred to group the enrolled patients with type 2 diabetes, the differences in the levels of glucose metabolism indexes were compared at first, and it was found that compared with those of non-anxiety group, serum MDA and ROS levels of patients with anxiety were higher, showing that anxiety can induce the increase of microinflammation in patients with type 2 diabetes; further compared with those of mild-to-moderate anxiety group, serum CRP, ASAA and IL-6 contents of severe anxiety group were higher, showing that with the microinflammation state is aggravating with the increase of anxiety, and confirming that the anxiety is positively correlated with the microinflammation status in patients with type 2 diabetes.

Many studies have shown that the blood glucose fluctuation in patients with diabetes is closely related to the oxidative stress state and vascular endothelial injury, whereas the oxidative stress state in patients with diabetes can objectively reflect the status of blood glucose control and the overall severity of the illness[13-14]. MDA and ROS are typical oxidation products, which have a strong oxidative effect and are the main substances that cause the vascular endothelial injury in diabetic patients[15-17]; CAT and GSH-Px are factors that have antioxidant effects, which can neutralize oxidant factors and inhibit the aggravation of oxidative stress response[18-20]. In this study, the differences in serum levels of these oxidative stress factors were compared between two groups of patients, and it was found that compared with those of non-anxiety group, serum MDA and ROS contents of patients with anxiety were higher while CAT and GSH-Px contents were lower, indicating that anxiety is the direct cause of increased oxidation products and decreased antioxidant capacity; further compared with those of mild-to-moderate anxiety group, serum MDA and ROS contents of severe anxiety group were higher while CAT and GSH-Px contents were lower, indicating that the oxidative stress degree in patients with type 2 diabetes is aggravating with the increase of anxiety, and confirming that anxiety is positively associated with the degree of oxidative stress in patients with type 2 diabetes.

The severity of anxiety in patients with type 2 diabetes is directly related to blood glucose control, microinflammation state and oxidative stress state, intervention of the patient's anxiety is expected to become the important auxiliary means to optimize the illness and treatment outcome of type 2 diabetes, and it is worthy of popularization and application in clinical practice in the future.
References


