Observation on the changes of serum polypeptide hormone and monoamine neurotransmitter in patients with gastric ulcer

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ABSTRACT

Objective: To observe the changes of serum polypeptide hormone and monoamine neurotransmitter in patients with Gastric ulcer. Methods: 186 patients with Gastric ulcer in our hospital during the period from January 2013 to September 2014 were collected in this study, who confirmed by gastroscope that 92 patients were in active period, 45 cases were in healing period and 49 cases of scar period, and 50 cases of healthy volunteers were included as normal the control group. Then the serum levels of gastrointestinal hormone such as gastrin (GAS), adrenomedullin (AM), motilin (MTL), somatostatin (SS) and calcitonin gene related peptide (CGRP) and the Gastric mucosa levels of neurotransmitter such as 5- serotonin (5-HT), substance P (SP), vasoactive intestinal peptide (VIP), norepinephrine (NE) were detected by ELISA. Results: The serum levels of GAS, AM, MTL of patients with gastric ulcer were significantly higher than the control group of the healthy, and SS and CGRP were significantly lower than the control group of the healthy, there was significant difference of serum levels of peptide hormone in different stages of disease in patients with gastric ulcer, \( P < 0.05 \). The gastric mucosa levels of 5-HT, SP and NE of patients with gastric ulcer were significantly lower than the control group of the healthy, while the VIP was higher than the control group of the healthy, there was significant difference of Gastric mucosa levels of neurotransmitter in different stages of disease in patients with Gastric ulcer, \( P < 0.05 \). Conclusion: There were obviously changes of serum peptide hormone and monoamine neurotransmitter in patients with gastric ulcer, which has a close correlation with the progress of the disease.

Peptic ulcer is a common gastrointestinal disease, the top two peptic ulcers are gastric ulcer and duodenal ulcer. It was thought that peptic ulcer is caused by autodigestion of Gastric acid and pepsin digestion on mucosa, but the fact is that peptic ulcer is related to a variety of other factors. The gastric mucous membrane will be impaired if the stimulation caused by factors such as gastric acid, pepsin, medicine, helicobacter pylori and diet bigger than the defense capability of mucous membrane, then ulcer lesions will appear[1]. Gastrointestinal hormone and monoamine neurotransmitters play an important role in regulating the attack and protection factors of gastrointestinal tract[2, 3]. There is short of report about the changes of levels of polypeptide hormones and neurotransmitters in patients with peptic ulcer currently. In order to explore the role of polypeptide hormones and neurotransmitters in the development of gastric ulcer, this study tested the changes of serum levels of polypeptide hormones and monoamine neurotransmitter of gastric mucous for both patients with peptic ulcer and healthy people.

1 Materials and methods

1.1 Clinical data

186 patients with gastric ulcer were collected since January 2013 to September 2014 in our hospital. All patients were suffered from Gastric ulcer proved by stomachoscopy. 92 patients were in active stage of gastric ulcer, 45 patients were in healing stage of gastric ulcer and 49 patients were in scar stage of Gastric ulcer. 50 healthy people were collected as the control group. Exclusion standard: people with contraindications of gastrointestinal endoscopy; patients with gastric cancer or other malignant tumor; people with abnormal hepatorenal function; patients with acute gastrointestinal bleeding;
Compared with scar stage occurred redness formed by the regeneration of epithelium (A2). There was no significant difference between two groups from the aspects of gender and age, they were comparable.

Active stage: the ulcer base was covered with white or yellow-white thick moss, there is congestion and edema on the mucous membrane. Healing stage: Size of ulcer narrowed, the moss is thinner, the redness formed by the regeneration of epithelium gathered round the ulcer, duplicature concentrated to the ulcer(H1), or the surface of ulcer all covered by regenerated epithelium, duplicature concentrated to the ulcer(H2). Scar stage

1.2 standard of classification of gastric ulcer stage

The gastric ulcer was classified into three stages according to the results of endoscopy. Active stage (A stage): it is the early stage of gastric ulcer disease; inflammation changes of ulcer edge is the main symptom, tissue repair has not yet appeared. Healing stage (H stage): size of ulcer is smaller, inflammation is degrading, and the redness formed by the regeneration of epithelium gathered round the ulcer, duplicature concentrated to the ulcer (H1), or the surface of ulcer all covered by regenerated epithelium, duplicature concentrated to the ulcer (H2). Scar stage

1.3 tested indexes and testing methods

5mL of fasting venous blood was taken and centrifuged for 5 minutes to separate serum. The serum was stored in refrigerator with -70° C for testing. Levels of gastrin(GAS), adrenomedullin(AM), somatostatin(SS) and alcitonin-gene-related peptide(CGRP) were tested by ELISA kit.

The sample of Gastric mucosa was taken by experienced doctor under gastroscope. The sample was washed with iced normal saline repeatedly and stored in refrigerator with -70° C for testing. Weighing and homogenate were applied after the samples were collected. The levels of 5 –hydroxytryptamine(5-HT), substance p(SP), vasoactive intestinal peptide(VIP) and noradrenaline(NE) were tested by ELISA kit.

1.4 statistical methods

SPSS17.0 software was adopted to analyze the data. Measurement data was tested by T test. Enumeration data was tested by χ² test. There was statistical significance when P<0.05.

2. Results

2.1 Comparison of serum levels of polypeptide hormones between gastric ulcer patients and healthy people

The serum levels of GAS, AM, MTL of gastric patients were significantly higher than those of healthy people, while the levels of SS and CGRP were significantly lower than those of healthy people, P<0.05. See table 1.

Table 1
Gastric ulcer patients compared with healthy crowd serum polypeptide hormone levels (pg/mL)

<table>
<thead>
<tr>
<th>group</th>
<th>GAS</th>
<th>AM</th>
<th>MTL</th>
<th>SS</th>
<th>CGRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastric ulcer (n=186)</td>
<td>121.69±48.76</td>
<td>116.32±21.03</td>
<td>568.97±183.25</td>
<td>7.31±2.15</td>
<td>3.42±4.69</td>
</tr>
<tr>
<td>Normal control (n=50)</td>
<td>58.32±11.03</td>
<td>44.63±9.32</td>
<td>296.21±52.36</td>
<td>13.62±3.98</td>
<td>32.14±6.86</td>
</tr>
</tbody>
</table>

Compared with normal the control group, P<0.05

2.2 Comparisons of serum levels of polypeptide hormones between gastric ulcer patients at different stages

The serum levels of GAS, AM, MTL of patients in the active stage were significantly higher than those of the patients in the healing or scar stage, the levels of SS and CGRP of patients in the active stage were significantly lower than those of the patients in the healing or scar stage. The levels of GAS, AM and MTL of patients in the healing stage were significantly higher than those of the patients in scar stage, the levels of SS and CGRP of patients in the healing stage were significantly lower than those of the patients in the healing or scar stage, P<0.05. See table 1.

Table 2
Different disease stage gastric ulcer patients serum peptide hormone level is more (pg/mL)

<table>
<thead>
<tr>
<th>group</th>
<th>GAS</th>
<th>AM</th>
<th>MTL</th>
<th>SS</th>
<th>CGRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>active (n=92)</td>
<td>169.86±26.98</td>
<td>145.98±15.13</td>
<td>796.56±121.35</td>
<td>5.24±2.65</td>
<td>2.36±2.13</td>
</tr>
<tr>
<td>Healing period (n=45)</td>
<td>112.01±21.02</td>
<td>106.32±14.67</td>
<td>512.47±102.16</td>
<td>8.91±2.60</td>
<td>3.56±1.85</td>
</tr>
<tr>
<td>Scarring stage (n=49)</td>
<td>98.74±16.35</td>
<td>81.31±12.35</td>
<td>359.67±85.33</td>
<td>11.69±3.32</td>
<td>8.97±2.06</td>
</tr>
</tbody>
</table>

Compared with scar stage, P<0.05; compared with healing stage, P<0.05

Table 1
Gastric ulcer patients compared with healthy crowd serum polypeptide hormone levels (pg/mL)

<table>
<thead>
<tr>
<th>group</th>
<th>GAS</th>
<th>AM</th>
<th>MTL</th>
<th>SS</th>
<th>CGRP</th>
</tr>
</thead>
<tbody>
<tr>
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<td>3.42±4.69</td>
</tr>
<tr>
<td>Normal control (n=50)</td>
<td>58.32±11.03</td>
<td>44.63±9.32</td>
<td>296.21±52.36</td>
<td>13.62±3.98</td>
<td>32.14±6.86</td>
</tr>
</tbody>
</table>

Compared with normal the control group, P<0.05
2.3 comparisons of serum levels of monoamine neurotransmitter of gastric mucosa between gastric ulcer patients and healthy people

Our testing results have found that the levels of 5-HT、SP and NE of gastric patients were significantly lower than that of healthy people, while the level of VIP was significantly higher than that of healthy people, $P<0.05$. See table 3.

Table 3

Gastric ulcer patients and healthy people in gastric mucosa tissue single amine neurotransmitter levels (ng/mg)

<table>
<thead>
<tr>
<th>group</th>
<th>5-HT</th>
<th>SP</th>
<th>VIP</th>
<th>NE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastric ulcer ($n=186$)</td>
<td>0.65±0.32$^2$</td>
<td>22.6±15.81$^1$</td>
<td>5.97±2.35</td>
<td>62.64±53.12$^2$</td>
</tr>
<tr>
<td>Normal control ($n=50$)</td>
<td>1.42±0.31</td>
<td>35.52±21.36</td>
<td>3.62±1.62</td>
<td>195.63±42.58</td>
</tr>
</tbody>
</table>

Compared with the control group, *$P<0.05$.

2.4 Comparisons of levels of monoamine neurotransmitter of gastric mucosa between gastric patients at different stages

The results of table 4 have shown that there is significant difference of levels of monoamine neurotransmitter of gastric mucosa between gastric ulcer patients at different stages. The levels of 5-HT、SP and NE of patients in the active stage were significantly lower than those of the patients in the healing or scar stage, the level of VIP of patients in the active stage was lower than that of the patients in the healing or scar stage. The levels of 5-HT、SP and NE of patients in the healing stage were significantly lower than those of the patients in scar stage, the level of VIP of patients in the healing stage was lower than that of the patients in the scar stage, $P<0.05$.

Table 4

Different stage disease in patients with gastric ulcer gastric mucosa tissues single amine neurotransmitter levels (ng/mg)

<table>
<thead>
<tr>
<th>group</th>
<th>5-HT</th>
<th>SP</th>
<th>VIP</th>
<th>NE</th>
</tr>
</thead>
<tbody>
<tr>
<td>activity ($n=92$)</td>
<td>0.41±0.19$^2$</td>
<td>18.36±12.30$^1$</td>
<td>7.96±2.15$^1$</td>
<td>41.32±32.60$^2$</td>
</tr>
<tr>
<td>Healing period ($n=45$)</td>
<td>0.63±0.15$^2$</td>
<td>23.32±11.56</td>
<td>5.24±2.03$^2$</td>
<td>65.98±26.31$^2$</td>
</tr>
<tr>
<td>Scarring stage ($n=49$)</td>
<td>1.02±0.18</td>
<td>27.89±9.36</td>
<td>3.89±1.63</td>
<td>98.62±51.36</td>
</tr>
</tbody>
</table>

Compared with scar stage, $^1P<0.05$; compared with healing stage, $^2P<0.05$.

3. discussions

Generally, gastric ulcer caused by helicobacter pylori infection. Patients who suffered from gastric ulcer become younger in average age in recent years. Patients with severe gastric ulcer can also suffered from upper gastrointestinal bleeding, perforation, pyloric obstruction or even cancer, which seriously not only affects the patient’s life quality, but also will endanger the patient’s life. The pathogenesis of gastric ulcer is that chronic inflamed gastric mucosa was corroded by gastric acid in high concentration. The chronic inflammation of gastric mucosa is caused by HP infection [5]. To some degree, hormone level changes of gastrointestinal tract can reflect the conditions of disease during the development of peptic ulcer. Polypeptide hormone involves in the movement and secretion of the gastrointestinal tract, as well as the regulation of blood circulation and electrolyte transport. It also connects the gastrointestinal system with the central nervous system and vegetative nervous system. It has complicated multiple chemical neurotransmitter, reflex pathway and loop network. Therefore, the gastrointestinal tract neurotransmitters are closely related to the physiological functions of the gastrointestinal tract[6].

Gastrointestinal hormones, such as GAS, ADM, MTL, SS and CGRP, play an important role in protecting and regulating the body from external invasion under normal physiological condition[7, 8]. GAS secretes by G cells of gastric antrum and the duodenum which can stimulate the secretion of gastric acid[9, 10]. MLT can induce the contraction of stomach and segmentation of small intestine obviously. The secretion of MLT can be enhanced by excessive secretion of gastric acid. ADM exists extensively in the intestinal tract and can resist the vasoconstriction caused by endothelin. SS can restrict G cells to secrete GAS. CGRP can restrict the secretion of gastric acid and movement of stomach and intestine[11-13]. This study has found that the serum levels of GAS, AM, MTL of gastric patients were significantly higher than that of healthy people, while the levels of SS and CGRP were significantly lower than those of healthy people, $P<0.05$.

Moreover, there is significant difference of serum levels of polypeptide hormones between gastric ulcer patients at different stages, $P<0.05$. It proved that excessive secretion of gastric acid under gastric ulcer condition can induce excessive secretion of GAS which can cause excessive secretion of gastric acid in turn. Excessive secretion of ADM can cause vasodilatation of stomach which is harmful for the repair of ulcer. Reduced secretion of SS and CGRP is the reason of excessive secretion of gastric acid. The levels of all polypeptide hormones are recovering with the repairing of ulcer.

The correlation of neurotransmitters and peptic ulcer is begun to be focused on in recent years. There is research showed that the functional gastrointestinal disorders under stress may related with...
the influence of many neurotransmitters on autonomic nervous system[3,6]. But there is short of research about the changes of gastrointestinal neurotransmitters after peptic ulcer occurred. 5-HT, SP and NE can excite gastrointestinal tract and play an important role in regulating gastrointestinal sensory system. The VIP can restrict the gastrointestinal contraction to delay the gastric emptying [14,15]. This study has shown that the levels of 5-HT, SP and NE of Gastric patients were significantly lower than those of healthy people, while the level of VIP was significantly higher than that of healthy people, there is significant difference of levels of monoamine neurotransmitter of gastric mucosa between gastric ulcer patients at different stages, P<0.05. the reason may be that the secretion of 5-HT, SP and NE increased under the inflammation of gastric mucosa which excited the gastrointestinal neurotransmitters and is harmful for the repair of ulcer. But the exact pathogenesis of monoamine neurotransmitter in gastric ulcer is still unclear. The further research about the changes of neurotransmitter in gastric ulcer can deepen the knowledge of gastric ulcer and provide evidence for treatment.

References