Clinical application comparison between laparoscopic repair and conventional open repair of perforated gastroduodenal ulcer

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ABSTRACT

Objective: To analyze the different effects of clinical application of laparoscopic repair and conventional open repair of perforated gastroduodenal ulcer. Methods: A total of 98 patients with gastroduodenal ulcer perforation were included in the study, hospital stay interval was from September 2012 to November 2014, and according to different surgeries they received, patients were divided into laparoscopic group and open surgery group (n=49). Peripheral blood and urine 1 h after operation were obtained from two groups to detect the differences in levels of pain-related indexes, intestinal wall damage-related indexes, Th1 and Th2 type factors and neurotransmitter type indexes. Results: Serum SP, NPY, PGE2 and HA values of laparoscopic group 1 h after operation were lower than those of open surgery group; urine LMR and IFABP of laparoscopic group 1 h after operation were lower than those of open surgery group; serum ET, PG, D-lactate, DAO and sICAM-1 values were lower than those of open surgery group; serum IFN-γ, TNF-α, IL-2, IL-4, IL-6 and IL-10 values of laparoscopic group 1 h after operation were lower than those of open surgery group; serum 5-HTP, 5-HIAA, NE and DA values of laparoscopic group 1 h after operation were lower than those of open surgery group, and Ach level was higher than that open surgery group. Conclusion: On the premise of protecting gastrointestinal function, laparoscopic repair of perforated gastroduodenal ulcer can reduce surgical inflammatory stress trauma in patients, and has positive clinical significance.

1. Introduction

Perforated gastroduodenal ulcer is clinical emergency, and timely surgery is needed to repair the perforation and avoid further aggravation of systemic inflammatory stress state. Laparoscopic and open surgery are the main methods for current clinical treatment of perforated gastroduodenal ulcer, they each have pros and cons in surgical trauma and operation simplicity, and the specific clinical choice has been controversial[1,2]. In order to define the application value of the two operating methods for gastrointestinal perforation, both operating methods were used in such patients in the study and were studied from the aspect of microenvironment homeostasis, and the specific report was as follows.

2. Case information and methods

2.1. Case information

A total of 98 patients with gastroduodenal ulcer perforation were included in the study, hospital stay interval was from September 2012 to November 2014, and according to different surgeries they received, patients were divided into laparoscopic group and open surgery group (n=49). Laparoscopic group included 25 male cases and 24 female cases, they were 31-70 years old and the average age was (57.39±5.93) years; open surgery group included 26 male cases and 23 female cases, they were 30-71 years old and the average age was (56.76±6.29) years. The two groups were not statistically different in gender, age, disease severity and other baseline information, P>0.05.

2.2 Specimen collection and index detection

Objective: To analyze the different effects of clinical application of laparoscopic repair and conventional open repair of perforated gastroduodenal ulcer. Methods: A total of 98 patients with gastroduodenal ulcer perforation were included in the study, hospital stay interval was from September 2012 to November 2014, and according to different surgeries they received, patients were divided into laparoscopic group and open surgery group (n=49). Peripheral blood and urine 1 h after operation were obtained from two groups to detect the differences in levels of pain-related indexes, intestinal wall damage-related indexes, Th1 and Th2 type factors and neurotransmitter type indexes. Results: Serum SP, NPY, PGE2 and HA values of laparoscopic group 1 h after operation were lower than those of open surgery group; urine LMR and IFABP of laparoscopic group 1 h after operation were lower than those of open surgery group; serum ET, PG, D-lactate, DAO and sICAM-1 values were lower than those of open surgery group; serum IFN-γ, TNF-α, IL-2, IL-4, IL-6 and IL-10 values of laparoscopic group 1 h after operation were lower than those of open surgery group; serum 5-HTP, 5-HIAA, NE and DA values of laparoscopic group 1 h after operation were lower than those of open surgery group, and Ach level was higher than that open surgery group. Conclusion: On the premise of protecting gastrointestinal function, laparoscopic repair of perforated gastroduodenal ulcer can reduce surgical inflammatory stress trauma in patients, and has positive clinical significance.
Peripheral venous blood was extracted from patients 1h after operation, underwent water bath and was centrifuged, and the supernatant was obtained and cryopreserved in -80 °C refrigerator for use; 5 mL of urine was obtained from drainage urine bag and centrifuged, and then the sediment was discarded. The following four aspects of indexes were detected: 1) pain-related indexes: substance P (SP), neuropeptide Y (NPY), prostaglandin E2 (PGE2) and histamine (HA); 2) intestinal wall damage-related indicators: urinary lactulose/mannitol ratio (LMR), intestinal fatty acid binding protein (IFABP), endotoxin (ET), pepsinogen (PG), D-lactate, diamine oxidase (DAO) and intercellular adhesion molecule-1 (sICAM-1); 3) Th1 and Th2 factors: Th1 cytokines interferon-γ (IFN-γ), tumor necrosis factor-α (TNF-α) and interleukin-2 (IL-2), and Th2 cytokines interleukin-4 (IL-4), interleukin-6 (IL-6) and interleukin-10 (IL-10); 4) neurotransmitters: indoles 5-hydroxytryptophane (5-HTP) and 5-hydroxyindole acetic acid (5-HIAA), and monoamine neurotransmitters norepinephrine (NE), dopamine (DA) and acetylcholine (Ach).

2.3 Statistical methods

Data obtained in the study was analyzed by SPSS 23.0 software, measurement data was in terms of Mean ± SD, comparison between group was by t test and P<0.05 was set as the standard of statistical significance in differences.

3. Results

3.1. Pain-related indexes

Analysis of enzyme-linked immunosorbent assay (ELISA) detection results of serum pain mediators SP, NPY, PGE2 and HA of two groups 1 h after operation was as follows: 1 h after operation, serum SP, NPY, PGE2 and HA levels of laparoscopic group were significantly lower than those of open surgery group, and differences in serum pain mediators SP, NPY, PGE2 and HA levels of two groups 1 h after operation were statistically significant (P<0.05), shown in Table 1.

3.2. Gastrointestinal function-related indexes

Analysis of gastrointestinal function-related indexes ET, PG, D-lactate, DAO and sICAM-1 in serum of two groups 1 h after operation was as follows: 1 h after operation, serum ET, PG, D-lactate, DAO and sICAM-1 levels of laparoscopic group were lower than those of open surgery group; analysis of gastrointestinal function-related indexes LMR and IFABP in urine was as follows: urine LMR and IFABP levels of laparoscopic group were lower than those of open surgery group. Differences in serum ET, PG, D-lactate, DAO and sICAM-1 levels as well as urine LMR and IFABP levels of two groups 1h after operation were statistically significant (P<0.05), shown in Table 2.

3.3. Th1 and Th2 type factor levels

Analysis of serum Th1 cytokines IFN-γ, TNF-α and IL-2 levels of two groups 1 h after operation was as follows: 1 h after operation, serum IFN-γ, TNF-α and IL-2 levels of laparoscopic group were significantly lower than those of open surgery group; analysis of serum Th2 cytokines IL-4, IL-6 and IL-10 levels of two groups 1 h after operation was as follows: 1 h after operation, serum IL-4, IL-6 and IL-10 levels of laparoscopic group were significantly lower than those of open surgery group. Differences in serum IFN-γ, TNF-α, IL-2, IL-4, IL-6 and IL-10 levels of two groups 1 h after operation were statistically significant (P<0.05), shown in Table 3.

3.4. Neurotransmitter type indexes

Analysis of serum indole neurotransmitters 5-HTP and 5-HIAA of two groups 1 h after operation was as follows: 1 h after operation,
serum 5-HTP and 5-HIAA levels of laparoscopic group were significantly lower than those of open surgery group; analysis of serum monoamine neurotransmitters NE, DA and Ach of two groups 1 h after operation was as follows: 1 h after operation, serum NE and DA levels of laparoscopic group were significantly lower than those of open surgery group, and Ach level was significantly higher than that open surgery group. Differences in serum 5-HTP, 5-HIAA, NE, DA and Ach levels of two groups 1 h after operation were statistically significant (P<0.05), shown in Table 4.

4. Discussion

Gastroduodenal ulcer is a common digestive system disease, digestive tract substances and enzymes can enter into the abdominal cavity and cause corrosion of abdominal viscera, severe peritonitis, etc, and operation is required for the perforation repair treatment[3]. Current repair of gastroduodenal ulcer perforation includes laparoscopic and open surgery, and there have been many controversies in clinical choice of laparoscopic and open surgery for gastrointestinal ulcer. Although open surgery causes huge trauma, it has clear intraoperative anatomical vision and quick operation, and reduces the impact of operation time extension on the body[4,5]; laparoscopic surgery has complex operation process and requires experienced doctors, but it magnifies abdominal cavity structure by dozens of times, greatly increases operating fineness and avoids accidental injury of abdominal viscera tissue, careful suture of the wound reduces the probability of postoperative wound leakage and second operation, and what’s more, laparoscopic operation reduces the peritoneal and intestinal exposure and fluid loss, which are beneficial for the re-establishment of postoperative microenvironment balance in patients[6,7]. In order to define the application effect of the two operating methods in patients with gastroduodenal ulcer perforation and provide reference for future choice of operating methods, the two operating methods were applied to patients included in the study, and the microenvironment changes brought by different operating methods were compared.

Both laparoscopic and open surgery will cause huge surgical trauma to patients, and the most important and most serious feeling of patients after gaining consciousness is pain. The occurrence of pain is associated with both surgical wound and intraoperative operation, the serological manifestation is the changes in the levels of a variety of pain-related factors, and they can be used as the objective measurement criteria for surgical trauma and postoperative pain degree. When acute soft tissue injury occurs, local blood circulation is blocked, relative hypoxia state can lead to the generation of a variety of algogenic substances such as substance P (SP), neuropeptide Y (NPY), prostaglandin E2 (PGE2), histamine (HA) etc., patients’ pain threshold decreases and pain sensitivity increases[8,9]. Study has shown that serum SP, NPY, PGE2 and HA values can rise significantly in early pain, and have a certain correlation with the degree of pain. The research results showed that serum SP, NPY, PGE2 and HA values of laparoscopic group 1h after operation were lower, indirectly indicating that patients’ perception of pain is lighter, and also showing that laparoscopic operation causes less damage to patients. Disease itself, operation etc., can all cause certain degree of damage to the gastrointestinal function of patients with perforated gastroduodenal ulcer, and some severe cases may even show difficult recovery of gastrointestinal function, malnutrition, difficulty in wound healing, and so on and so forth. Effective recovery of gastrointestinal function is the purpose of surgical treatment, and can also reflect the effectiveness of surgical treatment. There are many factors associated with gastrointestinal function, including urinary lactulose/mannitol ratio (LMR) and intestinal fatty acid binding protein (IFABP) in urine as well as endotoxin (ET), pepsinogen (PG), D-lactate, diamine oxidase (DAO) and intercellular adhesion molecule-1 (sICAM-1) in serum. IFABP is mainly excreted through the kidneys, has stable levels in the urine and is one of the detection indexes of early intestinal epithelium damage, and for patients with systemic inflammation and gastrointestinal damage, IFABP levels increase in early urine[10]. D-lactate is the metabolite of innate intestinal flora, and when the biological barrier function of intestinal mucosa is damaged, D-lactate enters into the circulatory system through the damaged intestinal mucosa, which leads to increased serum D-lactate level[11]. DAO is an intracellular enzyme in cytoplasm of mammal upper intestinal mucosa villus cells, and with the intestinal mucosa injury, DAO released in cells increases, and that entering into the intercellular space and blood increases[12]. sICAM-1 is synthesized by the cells and can promote the intercellular and cell-extracellular matrix adhesion, and its role in the inflammatory enteritis has received much attention. sICAM-1 is lowly expressed in normal intestinal tissue, and under intestinal mucosa inflammation, function damage and other states, sICAM-1 expression and distribution increase[12]. The research results showed that postoperative urine LMR and IFABP levels of laparoscopic group were lower, and serum ET, PG, D-lactate, DAO and sICAM-1 values were also lower, indicating that laparoscopic surgery causes less gastrointestinal function damage to patients than open surgery, and helps to promote the postoperative recovery of gastrointestinal function and nutrition intake of patients.

<table>
<thead>
<tr>
<th>Groups</th>
<th>n</th>
<th>5-HTP (μmol/L)</th>
<th>5-HIAA (μmol/L)</th>
<th>NE (ng/mL)</th>
<th>DA (ng/mL)</th>
<th>Ach (μg/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laparoscopic</td>
<td>49</td>
<td>0.73±0.07</td>
<td>0.63±0.05</td>
<td>59.37±4.39</td>
<td>65.29±5.88</td>
<td>893.27±78.34</td>
</tr>
<tr>
<td>Open surgery</td>
<td>49</td>
<td>1.29±0.13</td>
<td>1.42±0.13</td>
<td>90.52±8.66</td>
<td>98.13±9.05</td>
<td>573.28±45.21</td>
</tr>
<tr>
<td>t</td>
<td></td>
<td>6.384</td>
<td>5.283</td>
<td>9.283</td>
<td>8.374</td>
<td>11.283</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
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</table>
Intestinal contents and enzymes enter into the abdominal cavity in the case of gastrointestinal perforation, which can cause severe systemic acute response and massive expression of the body’s inflammatory factors, and meanwhile, is accompanied by the body’s immune dysfunction, mainly T cell-mediated immune response. According to the function and different types of cytokines it produces, CD4+T can be divided into Th1 and Th2. Th1 cells mainly produce IFN-γ, TNF-α and IL-2, and Th2 cells mainly produce IL-4, IL-6 and IL-10[13]. IFN-γ is the most typical Th1 cytokine, IL-4 is the most typical Th2 cytokine, and when the function of one subset increases, the function of the other subset decreases, causing Th1/Th2 shifting. IFN-γ can activate macrophages and raise the production of proinflammatory factors such as IL-1, and TNF-α stimulates IL-1, IL-6 and IL-8 synthesis and promotes inflammation; IL-2 stimulates further secretion of IFN-γ. IL-4 inhibits the proinflammatory factor of Th1 cells, and inhibits the secretion of IL-6, TNF-α, etc. IL-6 is the main cytokine of acute phase reaction, and can be induced and produced by TNF-α, IL-1 etc. IL-10 is a recognized inflammation and immunity inhibitor, and can inhibit the production of proinflammatory factors such as IL-6[14]. The research results showed that postoperative serum IFN-γ, TNF-α, IL-2, IL-4, IL-6 and IL-10 values of laparoscopic group were lower, and the lower levels of IL-4 and IL-10 may be caused by neutralization of excessive proinflammatory factors, indicating that laparoscopic surgery causes lighter postoperative inflammatory state and Th1/Th2 imbalance to patients.

Both gastrointestinal ulcer itself and surgical trauma would make patients in stress state, and stress can stimulate the production of all kinds of neurotransmitters and further influence each viscera function. In the case of stress, the hypothalamus-pituitary-adrenal medulla system accepts the immune response and excites the function. In the case of stress, the hypothalamus-pituitary-adrenal system activates the body’s autonomic nervous system, and neurotransmitters such as noradrenaline (NA), dopamine (DA) and acetylcholine (Ach) belong to monoamine neurotransmitters, and 5-hydroxytryptophane (5-HTP) and 5-hydroxyindole acetic acid (5-HIAA) belong to the indole neurotransmitters. NE and DA can promote continuous stress reaction and cause elevated blood pressure and accelerated heart rate, Ach has certain inhibiting effect on the above reaction, and NE, DA and Ach are in a relative balance state under physiological conditions[15]. 5-HTP is the precursor of 5-HT, 5-HIAA is the product after 5-HT metabolism, and with the production of peripheral nociceptive stimuli, algogenic chemical substances activate different receptors through direct and indirect effect, increasing 5-HTP and 5-HIAA expression. The research results showed that postoperative serum 5-HTP, 5-HIAA, NE and DA values of laparoscopic group were lower and Ach level was higher, indicating that laparoscopic surgery causes less traumatic stress to patients.

To sum up, it is concluded as follows: on the premise of protecting gastrointestinal function, laparoscopic repair of perforated gastroduodenal ulcer can reduce surgical inflammatory stress trauma in patients, and is worth popularization and application in clinical practice in the future.

References