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Analysis of Clinical Efficacy and Safety of Laparoscopic Repair in the Treatment of Gastroduodenal Perforation

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Abstract: *Objective:* To analyze the clinical efficacy and safety of laparoscopic repair in the treatment of gastroduodenal perforation. *Methods:* 96 patients with gastroduodenal perforation admitted to our hospital from March 2025 to March 2026 were selected and divided into 2 groups according to the surgical plan, with 48 patients in each group. The control group underwent traditional laparotomy perforation repair, and the observation group underwent laparoscopic perforation repair. The surgery-related indicators and complications were compared between the two groups. *Results:* The operation time of the observation group was slightly longer than that of the control group; however, the amount of intraoperative blood loss was significantly less; the time to get out of bed and hospital stay were shorter; and the postoperative complication rate was lower ($p < 0.05$). *Conclusion:* Laparoscopic repair has the characteristics of less trauma, faster postoperative recovery, and fewer complications when treating gastroduodenal perforation. The overall safety and therapeutic effect are better than traditional laparotomy. It is suitable for gradual promotion and use in primary hospitals. It will be more applicable to patients with a shorter onset time and acceptable basic physical conditions.

Keywords: Gastroduodenal perforation; laparoscopic repair; open repair; clinical efficacy; safety; postoperative complications

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1. Introduction

Gastroduodenal perforation is a very common acute abdomen in general surgery. This type of disease occurs quickly. Once the digestive juice in the gastrointestinal tract leaks into the abdominal cavity, it can easily induce diffuse peritonitis. If the treatment is not timely enough, septic shock will occur, which directly threatens the patient's life [1]. Gastroduodenal perforation is mostly caused by the continuous development of peptic ulcer. Many patients do not develop good eating habits, drink alcohol for a long time, have irregular work and rest, and have a history of gastric ulcer or duodenal ulcer. As the ulcer continues to erode the full-

thickness structure of the gastrointestinal wall, perforation will eventually occur. When gastrointestinal contents, gastric acid and bile enter the abdominal cavity, patients will soon develop severe abdominal pain like a knife, accompanied by typical symptoms such as abdominal muscle tension, tenderness and rebound tenderness, and infection-related manifestations will appear within a short period of time. Therefore, strengthening the treatment of such patients and controlling the condition in a timely manner are the keys to promoting patient recovery and improving prognosis [2]. In the past, when grassroots hospitals dealt with such emergencies, most of them would choose laparotomy. The operation process of laparotomy is intuitive, the technology is relatively mature, and it is widely used in clinical practice. However, it also has certain limitations. In long-term clinical work, the disadvantages of laparotomy have gradually emerged, such as large surgical trauma, long recovery period, and high risk of potential complications [3]. Laparoscopic surgery has significant advantages such as clear vision and precise operation. It relies on tiny puncture holes to complete all operations and causes very little damage to the abdominal wall. The camera system can also enlarge the view inside the abdominal cavity. Regardless of the specific location of the puncture, or scattered food residues and pus, it can be cleaned more thoroughly. In order to further analyze the clinical characteristics of laparoscopic minimally invasive repair, conduct research and demonstrate it, and apply it in practice, this study extracted the clinical data of 96 patients with gastroduodenal perforation, compared the actual therapeutic effects of laparoscopic repair and traditional open repair, and provided a reference basis for grassroots emergency surgery to select a more reasonable surgical plan that is consistent with clinical practice.

2. Materials and methods

2.1. General information

This study selected 96 patients with gastroduodenal perforation admitted to the General Surgery Department of our hospital from March 2025 to March 2026 as the research subjects. Inclusion criteria: All patients had sudden and persistent upper abdominal pain. Typical signs of peritoneal irritation could be seen during physical examination. After standing abdominal X-ray examination, free air under the diaphragm was found, and the patient was finally diagnosed with perforated gastroduodenal ulcer. Exclusion criteria: Patients with perforation time of more than 12 hours, septic shock, gastrointestinal malignant tumors, or severe cardiopulmonary, liver and kidney diseases that cannot tolerate surgery are not included in this study. According to the surgical plan, the patients were divided into a control group and an observation group, with 48 cases in each group. In the control group, there were 30 males and 18 females, aged 23 to 74 (47.2 ± 9.1) years old; in the observation group, there were 28 males and 20 females, aged 22 to 75 (46.8 ± 8.7) years old. There was no significant difference in the baseline data between the two groups. The results showed that $p > 0.05$. The two groups were comparable for conducting controlled studies.

2.2. Method

Patients in the control group were treated with epidural anesthesia, and a midline incision was made in the upper abdomen for surgery, and the abdominal wall was cut layer by layer before entering the abdominal cavity. The surgeon will carefully explore the specific location of the perforation and the size of the ulcer, thoroughly aspirate the gastrointestinal contents and inflammatory pus in the abdominal cavity, and then use absorbable sutures to repair the perforation intermittently. Use a large amount of warm saline to flush the

abdominal cavity repeatedly and thoroughly until the flushing fluid is clear, count the instruments, close the abdomen, and place a routine tube for drainage.

The patients in the observation group were given general anesthesia. First, adjust the patient's position so that the head is high and the feet are low. The operating table should be tilted sideways appropriately. A 10 mm puncture hole should be made in the umbilicus as an observation hole. Two additional 5mm operating holes should be selected in the upper abdomen and corresponding laparoscopic operating instruments should be inserted. Under the high-definition magnified field of view, the doctor will comprehensively explore the inside of the abdominal cavity, identify the specific location of the perforation, completely remove the fluid and food residue in the abdominal cavity, and thoroughly flush the wound. Use absorbable sutures for interrupted suture repair according to the size of the perforation, confirm that there is no leakage or other abnormalities at the repaired location, drag the omentum to the perforation suture site, cover the wound and ligate and fix it; after the operation, rinse the abdominal cavity, check for active bleeding, count the instruments and gauze, remove the laparoscope, and perform routine suturing and drainage. The patient's postoperative anti-infection, acid suppression, gastrointestinal decompression and other treatment plans remain the same as those of the control group. After the intestinal function is restored, the patient will gradually transition to a liquid or semi-liquid diet.

2.3. Observation indicators

(1) Record surgery-related indicators: mainly including the total operation time and intraoperative blood loss.
(2) Postoperative recovery indicators: time to first anal exhaust, time to get out of bed, and days in hospital.
(3) Statistics on the occurrence of postoperative complications such as incision infection, abdominal adhesion, peritoneal effusion, pulmonary infection, intestinal obstruction, etc.

2.4. Statistical processing

It is processed by SPSS26.0 software. The display method of measurement data is ($\bar{x} \pm s$), t test; the display method of count data is (%), χ^2 test. $p < 0.05$ means there is a big difference, indicating that the difference between the two groups is statistically significant.

3. Results

3.1. Comparison of surgery and postoperative recovery indicators between the two groups

The operation time of the observation group was longer than that of the control group, but the intraoperative blood loss, anal exhaust time, time to get out of bed, and hospitalization days were better than those of the control group (P<0.05). For detailed data, please refer to **Table 1**.

Table 1. Comparison of surgery and postoperative recovery indicators between the two groups of patients ($\bar{x} \pm s$)

Group	n	Operation time (min)	Intraoperative blood loss (mL)	Anal exhaust time (h)	Time to get out of bed (h)	Days of hospitalization (d)
Control group	48	73.6 ± 12.3	71.2 ± 16.5	49.3 ± 10.2	33.4 ± 8.1	9.7 ± 2.3
Observation group	48	86.5 ± 14.1	34.5 ± 11.2	27.1 ± 7.2	19.3 ± 5.8	5.9 ± 1.7

t	-	4.7765	12.7501	12.3191	9.8056	9.2051
p	-	0.0001	0.0000	0.0000	0.0000	0.0000

3.2. Comparison of postoperative complications between the two groups

In the control group, there were 3 cases of postoperative incision infection, 2 cases of abdominal adhesion, 4 cases of abdominal effusion, and 2 cases of pulmonary infection. The total complication rate reached 22.92%. In the observation group, there was only 1 case of abdominal effusion and 1 case of slight incision redness and swelling. There were no cases of serious infection or abdominal adhesion, and the total complication rate was only 4.17%. It is not difficult to see through comparison that the observation group was lower than the control group ($p < 0.05$). The specific data are shown in **Table 2**.

Table 2. Comparison of postoperative complications between the two groups (n (%))

Group	n	Incision infection	Abdominal adhesions	Ascites	lung infection	Overall incidence
Control group	48	3 (6.25)	2 (4.17)	4 (8.33)	2 (4.17)	11 (22.92)
Observation group	48	0 (0.00)	0 (0.00)	1 (2.08)	1 (2.08)	2 (4.17)
χ^2	-	-	-	-	-	7.2067
p	-	-	-	-	-	0.0073

4. Discussions

Gastroduodenal perforation is a surgical emergency. The core purpose of emergency surgery is to close the perforation site, remove contaminants in the abdominal cavity, and control abdominal infection. In addition to achieving this basic goal, it is also necessary to reduce the trauma caused by the operation as much as possible, reduce the occurrence of various postoperative complications, and speed up the patient's recovery process. Traditional laparotomy surgery has been carried out in primary hospitals for many years, and the surgical operation process is very mature. For patients with large perforations and cracks, serious abdominal contamination, and critical conditions, laparotomy surgery has a wide field of vision, direct operation methods, and can quickly complete the repair operation. This is also the main reason why laparotomy surgery has been the preferred surgical method for this type of disease for a long time in the past. The disadvantages of open surgery are very obvious in clinical practice. A long abdominal wall incision will cause great trauma. The repeated pulling and turning of the abdominal intestine and omentum during the operation will directly inhibit the peristalsis function of the intestine. Many patients will have obvious abdominal distension after surgery, and the time of exhaust will be delayed. Long-term bed rest will increase the risk of lung infection and deep vein thrombosis of the lower limbs. As a minimally invasive surgery, laparoscopic repair has outstanding advantages compared with open surgery [4]. First of all, the operation can be completed with only a few tiny puncture holes. The damage to the abdominal wall is very slight, and the amount of bleeding during the operation is also significantly reduced. The patient feels less pain after the operation and can get out of bed earlier and carry out activities. Getting out of bed early can effectively promote intestinal peristalsis and shorten the time for anal exhaust. It can also reduce the probability of lung infection and thrombosis complications.

The results of this study also fully confirmed these advantages. Except for the slightly longer operation time, the observation group had better recovery indicators than the control group, and the complication

rate was also significantly lower. Reasons for analysis: In the treatment of laparoscopic minimally invasive repair, the intra-abdominal structure can be clearly displayed through the magnification of the laparoscope, allowing the attending physician to accurately locate the perforation site, effectively complete the repair operation, and reduce the problem of incomplete repair due to blurred vision [5]; at the same time, compared with traditional laparotomy, it has less interference with the intra-abdominal environment and can reduce It affects gastrointestinal peristalsis function, thereby shortening the recovery time of gastrointestinal function after surgery, helping patients resume eating and independent activities earlier, and accelerating the overall recovery process [6]; in addition, the minimally invasive operation mode can more accurately handle the tissue around the lesion, reduce the stretch and damage to normal tissue, and lay the foundation for the rapid recovery of relevant physiological functions after surgery [7]. In addition, the surgical incisions of laparoscopic minimally invasive repair are smaller and more dispersed, avoiding the long incisions of traditional laparotomy. It not only reduces the risk of incision-related complications such as incision infection and fat liquefaction, but also reduces postoperative incision pain and improves patient comfort [8]; the intraoperative interference with the abdominal cavity is less, which can reduce the probability of intra-abdominal adhesions and reduce the risk of long-term complications; in addition, minimally invasive operations cause less bleeding and can effectively maintain the stability of patients' intraoperative vital signs. In addition, standardized postoperative treatment also plays a very critical role. No matter which surgical method is used, fasting and gastrointestinal decompression must be strictly implemented after the operation, sufficient amounts of acid-suppressing drugs are used to suppress gastric acid secretion, and antibiotics are rationally selected to control infection. Later, the diet will be gradually transitioned, and the patient will be urged to get out of bed as soon as possible. Only by doing this can the occurrence of complications be minimized and the patient's recovery speed be accelerated.

Comprehensive analysis based on the clinical diagnosis and treatment data of 96 patients with gastroduodenal perforation shows that compared with traditional laparotomy repair, laparoscopic repair has obvious advantages in terms of intraoperative bleeding control, postoperative intestinal function recovery, shortened hospitalization time, and complication prevention and control. Laparoscopic surgery can clearly explore the entire abdominal cavity and clean out pollutants more thoroughly. It also has the characteristics of less trauma, faster postoperative recovery, and higher overall safety. It is suitable for gradual promotion and application in grassroots general surgery. However, we must also be aware that this surgery has a certain operating threshold and the operation takes a relatively long time. It cannot be generalized in clinical application. The surgical plan needs to be selected individually based on the patient's perforation time, degree of abdominal contamination, and basic physical condition. When carrying out this type of emergency surgery, clinicians must balance the advantages of minimally invasive surgery with the safety bottom line of the surgery itself, strictly control the indications for the surgery, and conduct refined postoperative management to maximize the therapeutic effect of patients with gastroduodenal perforation and ensure the quality of the patient's long-term prognosis.

Disclosure statement

The author declares no conflict of interest.

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