Clinical Treatment and Analysis of Laparoscopic Enterolysis Surgery

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Abstract This work aims to explore the application value and clinical efficacy of laparoscopic enterolysis surgery for the treatment of adhesive intestinal obstruction. A total of 126 inpatient cases of intestinal adhesion were selected. In order to observe the effects and complications of surgery, the patients were randomly assigned into laparoscopic and laparotomy groups, with 63 cases in each group. The operative time, blood loss, postoperative ambulation time, exhaustion time, postoperative analgesia number of patients, and hospital days of the patients in the laparoscopic group were compared with those in the control group, and the differences were all statistically significant ($p < 0.05$). In the laparoscopy group, two patients experienced rupture of the small intestine during the surgery, but recovered well after endoscopic suture repair, although there was one case of postoperative pulmonary infection. The difference was statistically significant in the laparotomy group of patients, with one case of intestinal fistula, two cases of surgical wound infection, one case of incisional hernia, three cases of postoperative pulmonary infection, and one case of urinary tract infection. Compared with laparotomy, laparoscopic enterolysis surgery has shorter operative time, less

blood loss, faster postoperative recovery, and fewer complications.

Keywords Laparoscopy · Intestinal adhesion · Lysis · Laparotomy · Postoperative complications

Introduction

Bowel obstruction is a common surgery disease. The causes leading to bowel obstruction can be divided into mechanical and nonmechanical categories, among which the mechanical obstruction is the most common [1]. Intestinal adhesion is the most common iatrogenic cause of mechanical ileus [2], which is often related to abdominal or pelvic surgery [3]. Europe and the USA account for 60 to 80 % of adhesive ileus [4]. In China, the incidence of adhesive intestinal obstruction is above 60 %; of these, 10 to 20 % of the intestinal obstruction eventually progress to intestinal strangulation [5]. Studies have shown that the postoperative intestinal adhesion rate is 90 % or more; of these, about 80 % of the patients formed adhesions between the wound and the omentum, of whom more than 60 % had intestinal obstruction [6]. When intestinal obstruction occurs, several conservative treatments, such as fasting, fluid replacement, and administration of drugs, are often clinically adopted. Although obstruction can be temporarily relieved with nonsurgical treatment in 60 to 70 % of patients, bowel obstruction can reoccur due to intestinal adhesions; thus, many patients still require surgery to loosen adhesive parts. Such surgery employs laparotomy treatment from the original incision, but there is a high risk of injury and a high incidence of postoperative adhesions and problems of postoperative adhesions occurring for the second time. With more surgeries, the adhesions can be more severe [7], which brings great pain to the patients and increases the economic burden [8]. Therefore, despite great progress and

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development in modern surgical techniques, abdominal postoperative intestinal adhesion is still an unresolved problem [9].

The factors related to the occurrence of postoperative intestinal adhesion are surgical trauma, local inflammatory response, and the activator activity of peritoneal plasminogen; thus, reducing the peritoneal injury is of great significance for the prevention of intestinal adhesions. Laparoscopic surgery can reduce physical irritation and damage to the peritoneum and bowel and can also prevent abdominal viscera infection caused by exposure to air, which in turn reduces the inflammatory response [10]. In addition, due to the smaller risk of surgical injury, the patients experience early ambulation, which can promote gastrointestinal function and reduce fibrin deposition, ultimately avoiding the formation of a permanent adhesion. The hospital, in which the authors are employed, adopted laparoscopic surgery technology to treat 63 cases of intestinal adhesion and achieved good effect. The report is presented below.

Materials and Methods

General Information A total of 126 inpatient cases of intestinal adhesion were selected in the hospital in which the authors are employed, from August 2007 to December 2011; among them, 74 cases were males and 52 cases were females, with an average age of 55.7 years. The patients all had surgical history, and the previous surgeries were carried out between 8 months to 11 years, with an average of 36.8 months. The previous types of surgery were as follows: 20 cases of cholecystectomy, 16 cases of cesarean section, 14 cases of ovarian cystectomy, 16 cases of appendectomy, 4 cases of radical gastrectomy, 8 cases of duodenal ulcer perforation repair, 14 cases of intussusception surgery, 8 cases of traumatic rupture repair surgery of the small intestine, 8 cases of intestinal obstruction, 10 cases of splenectomy, and 8 cases of colon cancer surgery. All patients showed typical but varying degrees of abdominal pain, vomiting, hyperperistalsis performance, and hyperactive bowel sounds and stopped passing gas. The patients underwent preoperative abdominal B ultrasound examination, with plain film in standing position and abdominal CT examination as confirmation. Exclusion criteria were as follows: (1) presence of anesthesia and contraindications to surgery; (2) several histories of abdominal surgery; (3) combined with cardiovascular, liver, kidney, hematopoietic system, and other serious diseases, as well as mental illness; (4) intestinal tumors caused by obstruction; and (5) patients with extensive or close bowel adhesions through exploration. All patients were assigned into the laparoscopic group and the laparotomy group, with 63 cases in each group. The general data of the two groups of patients, such as gender, age, duration of disease, previous surgical methods, etc., were not statistically significant ($p > 0.05$).

Operational Method Laparoscopic group and laparotomy group surgeries were performed by the same surgeon. The entire group was given conservative treatment such as decompression, antispasmodic, rehydration, and enema. The laparotomy group, as a matter of routine, ran enterolysis surgery through the original incision. Operational methods of the laparoscopic group were endotracheal intubation under general anesthesia, indwelling urinary catheterization, and pneumoperitoneal pressure, which was maintained at about 14 mmHg. Based on the principle of raising the adhesions of the original incision by position, the intestinal injury was drooped, and the first puncture was administered at a distance of more than 6 cm from the original surgery scar to the maximum extent. This was done to avoid the adhesions of the neighboring bowel, so as not to cause bowel injury, and to determine other puncture holes (usually three to four) after implanting the laparoscopic equipment according to the general situations. The balteum caused the obstruction; hence, endoscopic hook cautery or coagulation shear was used to cut or remove the balteum and lift the oppression under the laparoscopic procedure. As for patients whose intestinal and abdominal walls adhered into a corner, or whose guts were sticking to each other, a coagulation separation scissors, elastic separating pliers, and ultrasound knife were used to sharply separate adhesions of the abdominal wall. Care was taken to staunch the bleeding during surgery, in order to avoid injury to the bowel and mesenteric vessels. The laparoscopic and other equipment were used interchangeably, after which the conglutination from different angles was released to avoid multiple adhesions and various obstructions. Two groups of patients were given great amounts of physiological saline to wash the abdominal cavity. After exhausting the washing fluid in the abdominal cavity, the patients were then injected with a sodium hyaluronate antiblocking agent into the adhesion site, and if there was any need for a drainage tube according to the exudation situation, a drainage tube would be placed. After the operation, antibiotics were used to prevent infection, and at the same time, the diet plan was specified based on the recovery of gastrointestinal function.

Observation Index The operative time, blood loss, postoperative recovery, length of hospital stay, and postoperative complications were identified in all the cases after surgery. In the laparotomy group, the total blood loss was the sum of aspirator-suctioned bleeding and the amount of blood that oozed from the gauze; in the laparoscopic group, the amount of blood loss was recorded based on the aspirator-suctioned bleeding.

Statistical Analysis Total data were analyzed using the SPSS 13.0 software system for statistical processing, with the measurement data expressed as $\bar{x} \pm s$. The enumeration data were analyzed using the χ^2 test. The measurement data were analyzed through ANOVA.

Results

Comparison of the Surgical and Postoperative Conditions Between the Two Groups Compared with the control group, the operative time, blood loss, postoperative ambulation time, exhaustion time, number of postoperative analgesia, and hospitalized days in the laparoscopic group of patients were statistically different ($p < 0.05$; Table 1).

Comparison of Intraoperative and Postoperative Complications Between the Two Groups Two patients of iatrogenic bowel perforation in the laparoscopic group experienced rupture of the small intestine, after suture under the laparoscope, one patient showed signs of good postoperative recovery, and one patient incurred postoperative pulmonary infection. The difference was statistically significant in the laparotomy group of patients ($p < 0.05$), with one case of intestinal fistula, two cases of surgical wound infection, one case of incisional hernia, three cases of pulmonary infection, and one case of urinary tract infection.

Discussion

Compared with traditional laparotomy, the laparoscopic treatment of intestinal obstruction presented its own unique advantages. Though traditional laparotomy can eliminate the original adhesion, the trauma is larger, the recovery time is longer, and the readhesion incidence is higher. As for the laparoscopic treatment of intestinal adhesion, the trauma is smaller, the bleeding is less, the postoperative pain is lighter, the intestinal peristalsis recovers faster, and further exploration and confirmation of the diagnosis during operation can be performed [11].

The results of this study showed that, in the laparoscopic group of patients, the mean operative time was 67 min, the mean intraoperative bleeding amount was 65 ml, the postoperative ambulation time was averaged at 25 h, the exhaust time was 19 h, and the average length of hospital stay was 4.8 days. All these values were significantly less than their counterpart values in the control group. Thus, the differences between the two groups were significant,

reflecting that the laparoscopic treatment of intestinal adhesions increases the benefits obtained by the patients. In our study, two cases of intestinal rupture appeared in the laparoscopic group. These were related to early operative techniques and an ineffective handling of the complications; these can also be related to the heavier intestinal wall edema at the site of obstruction. Saribeyoğlu et al. [12] applied the laparoscopic technique to treat 12 patients with intestinal adhesions, yielding a mean postoperative hospitalization time of 4.1 days, adverse reaction rate of 9.6 %, as well as mild and tolerable adverse reactions. O'Connor [13] included 2,000 cases of bowel obstruction in patients from 29 studies, of which 1,284 cases received laparoscopic surgery, accounting for 64 %. Thus, compared with traditional laparotomy surgery, laparoscopic surgery can reduce the recurrence rate of intestinal adhesion and surgery mortality as well as greatly shorten the hospital stay of the patients.

Nevertheless, the exact mechanism of intestinal adhesion is not entirely clear. Intestinal adhesion is still a common complication after abdominal surgery and thus considered a serious surgical problem [14]. Most scholars believe that intestinal adhesion is related with peritoneal tissue trauma, intra-abdominal inflammation, intestinal circulation disorder, postoperative ischemia or reperfusion, foreign bodies, trauma, etc. A more recognized injury and inflammation hypothesis [15] states that large amounts of fibrin are released when the peritoneum suffers surgical damage or irritation, and the reduced peritoneal fibrinolytic activity prevents them from being dissolved and absorbed. Thus, after deposition, the fibroblasts migrate and proliferate before finally forming an organized fibronectin, resulting in the growth and reorganization of the new capillaries to become a permanent adhesion. Animal studies have shown that the normal structure of the adhesive abdominal wall is damaged 1 to 3 days after injury, and the extravascular fibrin gradually forms into a clear and red-dyed adhesion tape. Then, 3 to 5 days after, an inflammatory exudate appears on the surface, and the mesothelial cells decrease or disappear to form fresh granulation tissue. Between 5 and 7 days, on the surface of the adhesion gap, a discontinuous layer of flat mesothelial cells, mesothelial cells, and fused fibroblasts emerge. Thus, it is not easy to

Table 1 The comparison of surgical time, blood loss, removed lymph nodes, postoperative recovery, and hospital days between the two groups

Group	Surgical time (min)	Blood loss (ml)	Ambulation time (h)	Unobstructed time (h)	Postoperative analgesia number of cases	The median length of hospital stay (days)
Laparotomy group	91.5±23.6	126.3±36.1	43.1±4.5	41.7±19.2	34	8.7±1.1
Laparoscopic group	67.1±19.8*	65.2±13.4*	25.8±5.1*	18.6±5.4*	10*	4.8±0.5*

* $p < 0.05$, comparison with the laparotomy group

identify the clear boundaries of the intestine and the peritoneum. In this case, the effective methods to prevent intestinal adhesion include enhancing the peritoneal fibrinolytic activity, reducing the trauma and its inflammatory response and isolating the damaged serosa, reducing the exudation of fibrinogen, and promoting the absorption [16].

At the same time, the selection of a good puncture hole needs attention. The best site is 6 cm above the original scar, which is the key to a successful operation [17]. Furthermore, the endoscopic equipment should be placed under direct vision to avoid punctures that cause bowel injury, the organs and abdominal wall adhesions should first be separated, and the operative field should be kept clear to further explore and create conditions for the separation of adhesions [18].

In addition, several points should be considered in reducing the occurrence of intestinal adhesions after surgery.

1. Maintain strict compliance with the aseptic concept. Upholding and strengthening the aseptic operation can maximally prevent bacteria from infecting the incisions; it can also reduce iatrogenic infection and resolve the infection caused by intestinal adhesion formation [19].
2. Prevent iatrogenic foreign body. The talc gloves should be cleaned, timely cleanup of resected tissue and abandoned lint should be observed, and gauze and tampons should be used as much as possible to reduce the possibility of various foreign bodies in the surgical field [20].
3. Define hemostasis. One must put an end to the massive tissue forceps, ligature, and cautery as well as reduce the possibility of tissue necrosis.
4. Reduce ischemic tissue. The ischemia part can be covered by omentum, even if postoperative adhesions emerged around the ischemic part; the omentum covers can exert protective effect without extensive adhesions.
5. Timely clean the fibrin exudate, pus, and secretions from the tissues.
6. Before closing the abdominal cavity, according to the anatomical location, smoothly organize the bowels and put the omentum in an orderly manner between the intestine and the incision for protection and isolation.
7. Pay attention to the postoperative recovery of the stomach and intestines, try as soon as possible to restore intestinal peristalsis, and inhibit fibrosis between the bowel and peritoneal wall, thereby reducing the severity and incidence of permanent adhesions [21].

In summary, intestinal adhesion enterolysis surgery under laparoscopic procedure is effective and feasible. Furthermore, the security and satisfactory postoperative long-term efficacy of such surgery have been demonstrated with a larger sample and a randomized controlled study [22]. By strictly adhering to and following the surgery indicators and operational rules, laparoscopic enterolysis surgery can be used as an ideal adhesive ileus treatment.

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References

1. Ohtsuka T, Nagai E, Toma H, Ohuchida K, Takanami H, Odate S et al (2011) Single-incision laparoscopy-assisted surgery for bowel obstruction: report of three cases. *Surg Today* 41:1519–1523
2. Saklani AP, Naguib N, Shah PR, Mekhail P, Winstanley S, Masoud AG (2013) Adhesive intestinal obstruction in laparoscopic vs open colorectal resection. *Color Dis* 15:80–84
3. Moran BJ (2007) Adhesion-related small bowel obstruction. *Color Dis* 9:39–44
4. Schölin J, Buunen M, Hop W, Bonjer J, Anderberg B, Cuesta M et al (2011) Bowel obstruction after laparoscopic and open colon resection for cancer: results of 5 years of follow-up in a randomized trial. *Surg Endosc* 25:3755–3760
5. Wang Q, Hu ZQ, Wang WJ, Zhang J, Wang Y, Ruan CP (2009) Laparoscopic management of recurrent adhesive small-bowel obstruction: long-term follow-up. *Surg Today* 39:493–499
6. Ten Broek RP, Van Goor H (2008) Laparoscopic reintervention in colorectal surgery. *Minerva Chir* 63:161–168
7. Zerey M, Sechrist CW, Kercher KW, Sing RF, Matthews BD, Heniford BT (2007) Laparoscopic management of adhesive small bowel obstruction. *Am Surg* 73:773–779
8. Tarhan OR, Barut I, Akdeniz Y, Sutcu R, Cerci C, Bulbul M (2008) Fibrinolytic responses of human peritoneal fluid in laparoscopic cholecystectomy: a prospective clinical study. *Surg Endosc* 22: 1008–1013
9. Ouaiissi M, Gaujoux S, Veyrie N, Denève E, Brigand C, Castel B et al (2012) Post-operative adhesions after digestive surgery: their incidence and prevention: review of the literature. *J Visc Surg* 149:e104–e114
10. Manohar T, Desai M, Desai M (2007) Laparoscopic nephrectomy for benign and inflammatory conditions. *J Endourol* 21: 1323–1328
11. Tokunaga M, Hiki N, Fukunaga T, Nunobe S, Ohyama S, Yamaguchi T (2010) Laparoscopy-assisted gastrectomy for patients with earlier upper abdominal open surgery. *Surg Laparosc Endosc Percutan Tech* 20:16–19
12. Saribeyoğlu K, Pekmezci S, Korman U, Kol E, Baca B, Günay S (2008) Selective laparoscopic adhesiolysis in the management of acute and chronic recurrent adhesive bowel obstruction. *Ulus Travma Acil Cerrahi Derg* 14:28–33
13. O'Connor DB, Winter DC (2012) The role of laparoscopy in the management of acute small-bowel obstruction: a review of over 2,000 cases. *Surg Endosc* 26:12–17
14. Vettoretto N, Carrara A, Corradi A, De Vivo G, Lazzaro L, Ricciardelli L et al (2012) Laparoscopic adhesiolysis: consensus conference guidelines. *Color Dis* 14:e208–e215
15. Polymeneas G, Theodosopoulos T, Stamatiadis A, Kourias E (2001) A comparative study of postoperative adhesion formation after laparoscopic vs open cholecystectomy. *Surg Endosc* 15:41–43
16. Binnebösel M, Klinge U, Rosch R, Junge K, Lynen-Jansen P, Schumpelick V (2008) Morphology, quality and composition in mature human peritoneal adhesions. *Langenbecks Arch Surg* 393: 59–66
17. Grafen FC, Neuhaus V, Schöb O, Turina M (2010) Management of acute small bowel obstruction from intestinal adhesions: indications

- for laparoscopic surgery in a community teaching hospital. *Langenbecks Arch Surg* 395:57–63
18. Reed KL, Stucchi AF, Leeman SE, Becker JM (2008) Inhibitory effects of a neurokinin-1 receptor antagonist on postoperative peritoneal adhesion formation. *Ann N Y Acad Sci* 11:116–126
 19. Mancini GJ, Petroski GF, Lin WC, Sporn E, Miedema BW, Thaler K (2008) Nationwide impact of laparoscopic lysis of adhesions in the management of intestinal obstruction in the US. *J Am Coll Surg* 207: 520–526
 20. Alpay Z, Saed GM, Diamond MP (2008) Postoperative adhesions: from formation to prevention. *Semin Reprod Med* 26:313–321
 21. Mathieu X, Thill V, Simoens CH, Smets D, Ngongang C, Debergh N et al (2008) Laparoscopic management of acute small bowel obstruction: a retrospective study on 156 patients. *Hepatogastroenterology* 55:522–526
 22. Rosin D, Zmora O, Hoffman A, Khaikin M, Bar Zakai B, Munz Y et al (2007) Low incidence of adhesion-related bowel obstruction after laparoscopic colorectal surgery. *J Laparoendosc Adv Surg Tech A* 17:604–607