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Original Article

Clinical efficacy and safety analysis of laparoscopic hernioplasty and open tension-free hernioplasty for abdominal incisional hernia

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Abstract: Background: At present, surgical treatment is the only way to cure abdominal incisional hernia. This study aimed to compare the clinical efficacy and safety of laparoscopic hernioplasty and open tension-free hernioplasty for abdominal incisional hernia. Materials and Methods: A retrospective analysis was performed on clinical data of 132 patients with abdominal incisional hernia, including 59 patients treated with open tension-free hernioplasty (open group) and 73 patients treated with laparoscopic hernioplasty (laparoscope group). Results: Compared with patients in open group, patients in laparoscope group had shorter operative time, postoperative hospital stays and recovery time of postoperative feeding, less intraoperative blood loss, number of postoperative analgesic usage and total hospitalization expenses, smaller intraoperative abdominal wall defect area, significantly lower incidence of total complications, and lower incidence of abdominal wall pain (all $P<0.05$). Postoperative recurrence rate of incisional hernia in laparoscope group (2.74%, 2 patients) was lower than that in open group (22.03%, 13 patients) ($P<0.05$). The results of logistic regression analysis showed that the surgical method, age, body mass index, hernia ring size and postoperative complications were independent risk factors for postoperative recurrence of abdominal incisional hernia (all $P<0.05$). Conclusion: Compared with open tension-free hernioplasty, laparoscopic hernioplasty has lower recurrence rate and complication incidence, better efficacy and safety, less surgical trauma, rapider recovery and lower treatment expenses, deserving to be used clinically. Surgical method, age, body mass index, hernia ring size and postoperative complications could lead to a large risk of postoperative recurrence.

Keywords: Laparoscopic hernioplasty, open tension-free hernioplasty, abdominal incisional hernia, efficacy, safety

Introduction

Abdominal incisional hernia is a common long-term complication caused by various factors such as poor healing of aponeuroses and incision infection after abdominal surgery, with the incidence of 2.0-11.0% [1, 2]. With the increasing ageing population and the increasing incidence of diseases requiring abdominal surgery, the incidence of abdominal incisional hernia has increased year by year. Because abdominal incisional hernia cannot heal itself, it has an impact on patient's aesthetic appreciation and daily life and a great impact on patient's quality of life. In severe cases, it even endangers the life and health of the patients. Abdominal incisional hernia has gradually become a clinically important disease that cannot be ignored [3, 4].

At present, surgical treatment is the only way to cure abdominal incisional hernia [5]. The current surgical methods are mainly open tension-free hernioplasty and laparoscopic hernioplasty. Open surgery has large trauma, slow postoperative recovery, high infection rate in the abdominal cavity and incision, many complications and high recurrent risk of postoperative incisional hernia, and it is necessary to dissociate a large area of abdominal wall tissues [6]. How to take a treatment method with good efficacy and small trauma has always been the

core that discussed by surgeons. With the development of laparoscopic treatment and the continuous improvement of medical conditions, laparoscopic treatment has been applied to the treatment of abdominal incisional hernia. Laparoscopic hernioplasty has the advantages of little trauma, low postoperative incidence of abdominal incision infection and rapid postoperative recovery, making it quickly accepted by the majority of surgeons [7, 8]. The postoperative recurrence rate of incisional hernia is one of the most important indicators for the evaluation of surgical results, but whether there is a significant difference in the postoperative recurrence rate between open tension-free hernioplasty and laparoscopic hernioplasty has been controversial. A study reported that the recurrence rate of incisional hernia after laparoscopic hernioplasty was lower than that after open surgery, and the other study also reported that there was no significant difference between the two surgeries [9, 10]. And there was also a study showing that the severity of complications after laparoscopic hernioplasty was higher than that after open tension-free hernioplasty [11].

Therefore, this study investigated the efficacy and safety of open tension-free hernioplasty and laparoscopic hernioplasty by retrospectively analyzing the clinical data of 132 patients with abdominal incisional hernia.

Patients and methods

Patients

A retrospective analysis was performed on clinical data of 132 patients with abdominal incisional hernia who were treated in Beijing Chao-Yang Hospital, Capital Medical University, including 59 patients treated with open tension-free hernioplasty (open group) and 73 patients treated with laparoscopic hernioplasty (laparoscope group), ranging from 24 to 85 years old. Inclusive criteria: 1) Patients with the history of abdominal surgery; 2) Patients who were diagnosed with abdominal incisional hernia by strict physical examination and imageological examination such as B-ultrasonography and computed tomography (CT); 3) Patients who met surgical indications for incisional hernia repair, such as unsatisfactory effects after conservative treatment, abdominal masses that could not be completely absorbed, etc.; 4) Patients with complete clinical data. Exclusive criteria: 1) Patients who underwent hybrid operation for incisional hernia repair; 2) Patients without follow-up data; 3) Patients with spontaneous hernia; 4) ASA grade > grade III; 5) Patients with severe heart, lung, and liver diseases; 6) The diameter of hernia ring >20 cm; 7) Patients with coagulation disorders and the history of abdominal incisional hernia and tumor. The study was approved by the Ethics Committee of Beijing Chao-Yang Hospital, Capital Medical University, and all patients and their families signed the informed consent form.

Methods

Preoperative preparation: CT and magnetic resonance imaging were performed preoperatively to determine the location and size of the abdominal wall defect as well as the state of the incisional hernia. The cause, method, and prognosis of patient's previous surgery were obtained in detail. The bellyband was worn for 2-3 weeks, and respiratory function exercises were taken by blowing balloons. Antibiotic pretreatment was given 30 min before surgery. The anesthesia method was general anesthesia or epidural anesthesia according to patient's own conditions and clinician's assessments, and patients in laparoscope group were treated with general anesthesia. Repair materials were Proceed patches (PMM3 15 cm × 11 cm to 30.5 cm × 30.5 cm, GMR207, Johnson & Johnson, USA).

Open tension-free hernioplasty: The abdominal wall was opened, and the incision hernia was repaired by Sublay method. The patch was placed and fixed between the posterior rectus tunica vaginalis and peritoneum. Then the abdominal wall was closed with non-absorbable suture (Shanghai Yuyan Instrument Co., Ltd., China), and the drainage tube was placed. After surgery, the abdomen was pressurized with the bellyband for 2 weeks, and the routine nursing was performed.

Laparoscopic hernioplasty: Three incisions were made 5 cm from the original incision, which were used as observation hole, operation hole and traction hole, respectively. The CO_2 pneumoperitoneum was established with a pressure of 10-15 mmHg. After the determination of the location, size and edge of the hernia ring under laparoscope, the patch of an appropriate size was placed and fixed. Then the

Table 1. General data

Group	Open (n=59)	Laparoscope (n=73)	χ^2/t	P
Gender (n, %)			0.001	0.979
Male	26 (44.07)	32 (43.84)		
Female	33 (55.93)	41 (56.16)		
Age (year)	54.9±8.7	55.7±8.3	0.588	0.557
BMI (n, %)			0.145	0.703
≤25 kg/m^2	16 (27.12)	22 (30.14)		
>25 kg/m^2	43 (72.88)	51 (69.86)		
Hernia ring size (cm^2)	7.08±2.14	6.93±2.11	0.404	0.687
Incisional hernia type (n, %)			3.420	0.331
Small (≤4 cm)	14 (23.73)	21 (28.77)		
Middle (>4 cm, ≤8 cm)	25 (42.37)	35 (47.95)		
Large (>8 cm, ≤12 cm)	16 (27.12)	16 (21.92)		
Giant (>12 cm)	4 (6.78)	1 (1.37)		
Incision site			0.010	0.920
Superior belly	28 (47.46)	34 (46.58)		
Inferior belly	31 (52.54)	39 (53.42)		
ASA grade (n, %)			0.531	0.466
Grade I	36 (61.02)	49 (67.12)		
Grade II	23 (38.98)	24 (32.88)		
Albumin (g/L)	41.59±4.13	42.16±4.15	0.786	0.433
Comorbidity (n, %)			0.011	0.916
Hypertension	17 (28.81)	19 (26.03)		
Diabetes	2 (3.39)	2 (2.74)		
Smoking history (n, %)			1.460	0.227
Yes	40 (67.80)	42 (57.53)		
No	19 (32.20)	31 (42.47)		

Note: BMI: body mass index; ASA: American Society of Anesthesiologists.

pneumoperitoneum was relieved, and the incisions were closed with non-absorbable suture. After surgery, the abdomen was pressurized with the bellyband for 2 weeks, and the routine nursing was performed.

Outcome measurements

Postoperative recurrence rate of incisional hernia and postoperative complications (seroma, incision infection, etc.) in the two groups were recorded. Surgery-related indicators (operative time, postoperative hospital stays, intraoperative blood loss, etc.), and intraoperative abdominal wall defect area between the two groups were compared.

Statistical analysis

SPSS 19.0 (Asia Analytics For-merly SPSS China) was used to analyze all clinical data. The enumeration data were expressed as n (%), and the ratio was compared by χ^2 test. The measurement data were expressed as mean ± sd, and the comparison between two groups was performed by independent sample t test. There was a significant difference at P<0.05.

Results

General data

There were 59 patients in open group, including 26 males and 33 females, at the age of 54.9± 8.7 years old, and 73 patients in laparoscope group, including 32 males and 41 females, at the age of 55.7±8.3 years old. There were no significant differences in gender ratio and age between the two groups (both P>0.05). There were also no significant differences in other data such as body mass index, hernia ring size, incisional hernia type, ASA grade, comorbidity and smoking history between the two groups (all P> 0.05, **Table 1**).

Postoperative recurrence rate of incisional hernia

Postoperative recurrence rate of incisional hernia in laparoscope group (2.74%, 2 patients) was lower than that in open group (22.03%, 13 patients), and there was a statistical difference in recurrence rate between the two groups (P=0.001, **Figure 1**).

Postoperative complications

The incidence of total complications in laparoscope group (26.03%, 19 patients) was significantly lower than that in open group (47.46%, 28 patients) (P<0.05). The analysis of the incidence of each complication showed that the incidence of abdominal wall pain in laparoscope group was lower than that in open group (P<0.05), and there were no significant differences in the incidence of other complications, such as intestinal canal injury, incision infection, seroma, intestinal obstruction and hemor-

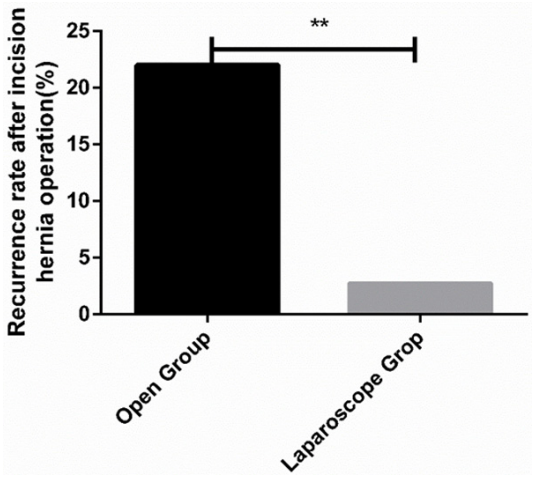

Figure 1. Postoperative recurrence rate of incisional hernia. Postoperative recurrence rate of incisional hernia in laparoscope group was lower than that in open group. **P<0.01.

rhage, between the two groups (all P>0.05, **Table 2**).

Surgery-related indicators

Patients in laparoscope group had shorter operative time, postoperative hospital stays and recovery time of postoperative feeding, and less intraoperative blood loss, number of postoperative analgesic usage and total hospitalization expenses compared with patients in open group (all P<0.05, **Table 3**).

Intraoperative abdominal wall defect area

Intraoperative abdominal wall defect area in laparoscope group (18.35±8.64 cm^2) was less than that in open group (35.42±14.17 cm^2), and there was a statistical difference in the defect area between the two groups (P<0.001, **Figure 2**).

Multivariate analysis of postoperative recurrence of abdominal incisional hernia

The results of multivariate logistic regression analysis showed that the surgical method, age, body mass index, hernia ring size and postoperative complications were independent risk factors for postoperative recurrence of abdominal incisional hernia (all P<0.05, **Table 4**).

Discussion

The incidence of abdominal incisional hernia (about 1.5%) is the third highest in the incidence of all external abdominal hernia, which is an unavoidable complication after abdominal surgery. It is difficult to achieve desired therapeutic effect with conservative treatment, and the recurrence rate is high. Positive surgical treatment is the only effective method for the radical treatment of abdominal incisional hernia [12, 13]. With the increase of medical level, people's requirements for treatment are getting higher and higher. Under the premise of not affecting the therapeutic effect, it is always the direction of the surgeon's unremitting efforts to seek a treatment method with small trauma and high security [14]. This study investigated the efficacy and safety of open tension-free hernioplasty and laparoscopic hernioplasty by retrospectively analyzing the clinical data of patients with abdominal incisional hernia who were treated with surgery.

In this study, the clinical data of patients with abdominal incisional hernia were screened strictly according to the inclusive and exclusive criteria. There was no significant difference in general data between the two groups, and all patients underwent surgery successfully. It suggested that the subjects were comparable, and the results had a certain degree of credibility. At present, clinicians have not reached a consensus on the method for abdominal incisional hernia repair. Open tension-free hernioplasty needs to separate the scar tissue that has been stably formed after the previous surgery along the original incision. Large surgical trauma and the occurrence of complications, such as incision infection, patch displacement and chronic pain, limit the application of open tension-free hernioplasty. Laparoscopic hernioplasty opens the incision away from the original surgical incision and inserts patches. It does not need to remove the scar tissue at the original surgical incision. Due to small incision, effective dispersion of the intra-abdominal pressure, less pain and rapid recovery as well as the gradual improvement of laparoscopic technique, laparoscopic hernioplasty is more and more accepted by patients and clinicians [15, 16]. In this study, patients in laparoscope group had shorter operative time, postoperative hospital stays and recovery time of postoperative feeding, and less intraoperative abdominal wall defect area, blood loss, number of postoperative analgesic usage and total hospitalization expenses compared with patients in open group. This was consistent with the re-

Table 2. Postoperative complications

Group	Open (n=59)	Laparoscope (n=73)	χ^2	P
Intestinal canal injury	4 (6.78)	5 (6.85)	0.000	0.987
Incision infection	5 (8.47)	4 (5.48)	0.461	0.497
Seroma	3 (5.08)	3 (4.11)	0.072	0.789
Abdominal wall pain	11 (18.64)	4 (5.48)	5.614	0.018
Intestinal obstruction	4 (6.78)	3 (4.11)	0.463	0.496
Hemorrhage	1 (1.69)	0 (0.00)		
Incidence of total complications	28 (47.46)	19 (26.03)	6.536	0.011

Table 3. Surgery-related indicators

Group	Open (n=59)	Laparoscope (n=73)	t	P
Operative time (min)	151.35±43.12	125.71±42.56	3.421	0.001
Postoperative hospital stays (days)	7.81±1.58	5.62±1.24	8.923	<0.001
Intraoperative blood loss (mL)	41.14±9.86	34.21±8.12	4.435	<0.001
Recovery time of postoperative feeding (days)	1.72±0.74	1.28±0.57	3.859	<0.001
Number of postoperative analgesic usage (times)	3.51±1.21	2.47±1.22	4.887	<0.001
Total hospitalization expenses (ten thousand yuan)	2.72±0.15	2.15±0.12	24.692	<0.001

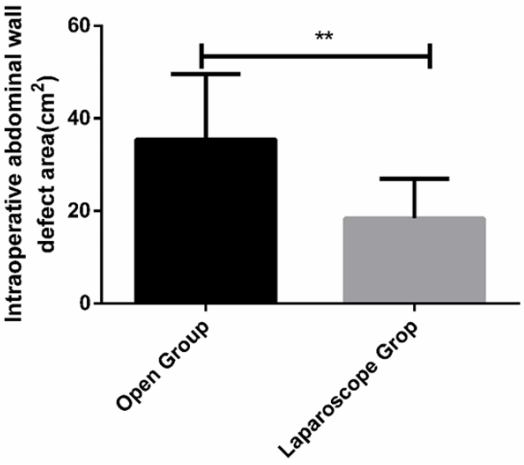

Figure 2. Intraoperative abdominal wall defect area. Intraoperative abdominal wall defect area in laparoscope group was smaller than that in open group. **P<0.001.

sults of current related research, which was the advantage of laparoscopic treatment. Patients undergoing laparoscopic hernioplasty had small incisions, less tissue damage, less blood loss, short recovery time, and low hospitalization expenses [17, 18]. The incidence of postoperative complications is an important indicator for assessing the safety of incisional hernia repair. The analysis of the incidence of total complications in this study showed that patients in laparoscope group had significantly lower incidence of postoperative complications, and lower incidence of abdominal wall pain compared with patients in open group, which was consistent with the results of a previous study [19]. In the previous study, the area of abdominal wall muscle tissue dissociation and damage caused by laparoscopic hernioplasty was lower than that of open tension-free hernioplasty, which reduced the occurrence of postoperative complications. However, in this study we did not find the difference in the incidence of intestinal canal injury between the two groups. A study had reported that the incidence of intestinal canal injury in patients undergoing open tension-free hernioplasty was lower than that in patients undergoing laparoscopic hernioplasty, and they believed that the small operating space of laparoscopic hernioplasty increased the incidence of intestinal canal injury [20]. Recurrence rate is an important indicator to evaluate the efficacy of incisional hernia repair. A study had reported that the postoperative recurrence rate of open tension-free hernioplasty was lower than that of laparoscopic hernioplasty, and the other study had shown that there was no significant difference in the postoperative recurrence rate between the two kinds of hernioplasty [21, 22]. Our results showed that laparoscopic hernioplasty had a lower postoperative recurrence rate. A study had found that the larger the intra-

Table 4. Multivariate analysis of postoperative recurrence of abdominal incisional hernia

Factor	Group	95% CI	P
Surgical method	Open vs. Laparoscope	1.062 (0.973-1.224)	0.036
Age (year)	<60 vs. ≥60	1.112 (1.061-1.165)	0.025
Gender	Male vs. Female	0.028 (0.143-0.811)	0.111
BMI (kg/m^2)	<25 vs. ≥25	1.172 (1.074-1.277)	0.001
Hernia ring size (cm)	<7 vs. ≥7	1.075 (1.011-1.142)	0.034
Incisional hernia type	<8 vs. ≥8	1.018 (0.087-1.031)	0.161
Incision site	Superior belly vs. Inferior belly	0.798 (0.638-1.081)	0.133
Albumin (g/L)	<35 vs. ≥35	1.301 (1.102-1.831)	0.091
Hypertension	Yes vs. No	1.224 (1.041-1.421)	0.058
Diabetes	Yes vs. No	1.017 (0.987-1.012)	0.181
Smoking	Yes vs. No	1.445 (0.873-2.329)	0.136
Postoperative complications	Yes vs. No	1.075 (1.021-1.154)	0.012

Note: CL: confidence limit; BMI: body mass index.

operative abdominal wall defect area, the higher the postoperative recurrence rate of incisional hernia [23]. Our results showed that the intraoperative abdominal wall defect area in laparoscope group was significantly smaller than that in open group. The results of multivariate logistic regression analysis showed that the surgical method, age, body mass index, hernia ring size and postoperative complications were independent risk factors for postoperative recurrence of abdominal incisional hernia. Factors affecting the postoperative recurrence rate also include inappropriate patch size for defect area, unfixed patch, smoking, and high-carbonhydrate diet, etc [24, 25]. There are some shortcomings in this study. This is a retrospective study. Data bias caused by nationalities and dietary habits is not well controlled. Proficiency of laparoscopic techniques also causes bias in results. Therefore, these results still need to be verified by a large number of more strict randomized controlled trials with larger sample size.

In summary, compared with open tension-free hernioplasty, laparoscopic hernioplasty has lower recurrence rate and complication incidence, better efficacy and safety, less surgical trauma, rapider recovery and lower hospitalization expenses, deserving to be used clinically. Surgical method, age, body mass index, hernia ring size and postoperative complications could lead to a large risk of postoperative recurrence.

Disclosure of conflict of interest

None.

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