

## **Risk factors for prolonged operative time and hospitalization of patients undergoing laparoscopic incisional hernia repair.**

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### **Abstract**

**Background:** Incisional hernia is a common complication after operation and could be alleviated by laparoscopic incisional hernia repair. This study aimed to explore risk factors for prolonged operative time and hospitalization of patients undergoing laparoscopic incisional hernia repair.

**Methods:** 82 patients who received laparoscopic incisional hernia repair between January 2010 and June 2015 were divided into 2 groups including duration of surgery <120 min group and >120 min group, or length of stay <5 day group and >5 day group. Risk factors such as the age, gender, BMI, duration of hernia, comorbidities, multiple hernias, recurrent hernias, hernia size, mesh size, duration of surgery, and complication were analysed.

**Results:** Complication rate was 19.51%. The proportions of multiple hernias, recurrent hernias, hernia size >8 cm and mesh size >300 cm<sup>2</sup> of duration of surgery >120 min group were higher than those of duration of surgery <120 min group. Multiple hernias, recurrent hernias, and mesh size >300 cm<sup>2</sup> were risk factors for prolonged operative time. The proportions of age >55 years, multiple hernias, recurrent hernias, hernia size >8 cm, mesh size >300 cm<sup>2</sup> and duration of surgery >120 min of length of stay >5 day group were higher than those of length of stay <5 day group. Advanced age, mesh size >300 cm<sup>2</sup> and prolonged operative time were risk factors for prolonged hospitalization.

**Conclusion:** Patients with multiple, larger and recurrent hernias have longer operative time and hospitalization during laparoscopic incisional hernia repair, and should be paid more attention.

**Keywords:** Laparoscopic, Incisional hernia repair, Operative time, Hospitalization.

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### **Introduction**

Abdominal incisional hernia is a common complication after abdominal surgery, and its prognosis is far worse than that of inguinal hernia. Compared with the traditional laparotomy surgery, Laparoscopic Incisional Hernia Repair (LIHR) has advantages of small incision, small tension, fewer complications, shorter hospital stay and low recurrence rate [1-3]. LIHR has been widely used clinically in recent years, but some patients undergoing LIHR have issues of long operation time and long hospital stay time, which brings some problems for the clinicians to make optimal decision [4-6]. In this study we enrolled patients who underwent LIHR and analysed their clinical data retrospectively to investigate the risk factors for prolonged operation time and hospital stay.

### **Materials and Methods**

#### **Subjects**

Total 82 patients who underwent LIHR at our hospital from January 2010 to June 2015 were enrolled in this study,

including 37 males and 45 females. Their age was  $53.5 \pm 12.2$  years, and Body Mass Index (BMI) was  $31.7 \pm 9.2$ . All patients provided informed consent. The study was approved by Ethics Committee of The Yinzhou Second Hospital in 2009 (Approval No. YSH08102009). All surgeries were carried out by the same treatment group.

#### **Grouping and analysis**

To analyse the factors that affect Duration of Surgery (DOS), patients were divided into DOS <120 min group (n=44) and DOS >120 min group (n=38). To analyse the factors that affect Length of Stay (LOS), patients were divided into LOS <5 day group (n=36) and LOS >5 day group (n=46). The information on the age, gender, BMI, duration, complications, defect diameter, patch size, operative time and postoperative complications in each group was collected and analysed.

#### **Statistical analysis**

Statistical software SPSS18.0 was used for statistical analysis. Measurement data were represented as  $\bar{x} \pm s$ .  $\chi^2$  test; Fisher exact test and multivariate logistic regression analysis were

used to analyse risk factors to affect duration of surgery and length of stay.  $P < 0.05$  was considered statistically significant.

## Results

### General characterizes of the patients

Among the 82 patients enrolled in this study, 19 cases had complications such as hypertension, diabetes, liver and kidney dysfunction. The duration of hernia was  $33.5 \pm 28.4$  months. Among them, 29 cases had recurrent hernia; 52 cases had single hernia, 30 cases had multiple hernia. Hernia area was  $63 \pm 78$  cm<sup>2</sup>; patch size was  $303 \pm 224$  cm<sup>2</sup>; operative time was  $136.1 \pm 43.8$  min; postoperative hospital stay was  $5.3 \pm 2.1$  day. Only one case had intra-operative complication. At 1 month after operation, the overall incidence of postoperative complications was 19.51%, including 3 cases of wound infection, 4 cases of seroma, 2 cases of nausea and vomit, 2 cases of uroschisis, 2 cases of pneumonia, 3 cases of chronic abdominal pain, 1 case of recurrence (patient refused additional treatment).

### Factors that affect duration of surgery (DOS)

Compared with DOS < 120 min group, DOS > 120 min group had higher proportion of multiple hernia, recurrent hernia, defect diameter > 8 cm and patch > 300 cm<sup>2</sup> ( $P < 0.05$ ), but the gender, age, BMI, complications, and duration of disease showed no significant difference in the two groups ( $P > 0.05$ , Table 1).

Logistics multivariate regression analysis showed that an increase in the number of sac, enlargement of patches and recurrent hernia were risk factors for prolonged duration of surgery (Table 2).

### Factors to affect length of stay (LOS)

Compared with LOS < 5 day group, the proportions of age > 55, multiple hernia, recurrent hernia, defect diameter > 8 cm, patch > 300 cm<sup>2</sup> and DOS > 120 min were higher in LOS > 5 day group ( $P > 0.05$ , Table 3).

Logistics multivariate regression analysis showed that the age, patch enlargement and extended operation time were risk factors for prolonged postoperative hospital stay (Table 4).

**Table 1.** Comparison of clinical data in DOS < 120 min group and DOS > 120 min group.

	DOS < 120 min (n=44)	DOS > 120 min (n=38)	$\chi^2$	P
Gender (female/male)	25/19 (56.8/43.2)	20/18 (52.6/47.4)	0.15	>0.05
Age (<55 years old/>55)	24/20 (54.5/45.5)	18/20 (47.4/52.6)	0.42	>0.05
BMI (<28/>28)	13/31 (29.5/70.5)	12/26 (31.6/68.4)	0.04	>0.05

Complications (no/yes)	36/8 (81.8/18.2)	27/11 (71.1/28.9)	1.33	>0.05
Duration of disease (<1 year/>1 year)	25/19 (56.8/43.2)	17/21 (44.7/55.3)	1.19	>0.05
Single hernia/Multiple hernia	36/8 (81.8/18.2)	16/22 (42.1/57.9)	13.86	<0.01
First occurrence/relapse	37/7 (84.1/15.9)	16/22 (42.1/57.9)	15.72	<0.01
Defect diameter (<8 cm/>8 cm)	28/16 (63.6/36.4)	8/30 (21.1/78.9)	15.01	<0.01
Patch (<300 cm <sup>2</sup> />300 cm <sup>2</sup> )	32/12 (72.7/27.3)	10/28 (26.3/73.7)	17.58	<0.01

DOS: Duration of Surgery; BMI: Body Mass Index.

**Table 2.** Multivariate logistic regression analysis of factors that affect DOS.

Variable	Experiment (B)	95% interval	Confidence P
Number of hernial sac	4.258	1.386-7.130	<0.05
Multiple hernia	6.245	2.154-10.336	<0.05
Defect diameter	1.587	0.477-2.697	>0.05
Patch size	5.321	1.624-9.018	<0.05

DOS: Duration of Surgery.

**Table 3.** Comparison of clinical data in LOS < 5 day group and LOS > 5 day group.

	LOS < 5 day (n=36)	LOS > 5 day (n=46)	$\chi^2$	P
Gender (female/male)	19/17 (52.8/47.2)	26/20 (56.5/43.5)	0.11	>0.05
Age (<55 years old/>55)	23/13 (63.9/36.1)	13/27 (28.3/71.7)	4.12	<0.05
BMI (<28/>28)	13/23 (36.1/63.9)	12/34 (26.1/73.9)	0.96	>0.05
Complications (no/yes)	30/6 (83.3/16.7)	33/13 (71.7/28.3)	1.52	>0.05
Duration of disease (<1 year/>1 year)	17/19 (47.2/52.8)	25/21 (54.3/45.7)	0.41	>0.05
Single hernia/Multiple hernia	28/8 (77.8/22.2)	24/22 (52.2/47.8)	5.71	<0.05
First occurrence/relapse	29/7 (80.6/19.4)	24/22 (52.2/47.8)	7.12	<0.01
Defect diameter (<8 cm/>8 cm)	26/10 (72.2/27.8)	10/36 (21.7/78.3)	20.90	<0.01
Patch (<300 cm <sup>2</sup> />300 cm <sup>2</sup> )	28/8 (77.8/22.2)	14/32 (30.4/69.6)	18.12	<0.01
DOS (<120 min/>120 min)	25/11 (69.4/30.1)	19/27 (41.3/58.7)	6.43	<0.05

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LOS: Length of Stay; DOS: Duration of Surgery; BMI: Body Mass Index.

**Table 4.** Multivariate logistic regression analysis of factors that affect LOS.

Variable	Odds ratio	95% Interval	Confidence P
Age	1.914	1.269-2.559	<0.05
Number of hernial sac	1.574	0.741-2.407	>0.05
Multiple hernia	1.358	0.846-1.870	>0.05
Defect diameter	2.036	0.846-3.226	>0.05
Patch size	5.482	2.086-8.878	<0.05
Operation time	7.264	2.227-12.301	<0.05

LOS: Length of Stay.

### Discussion

The incidence of incisional hernia after abdominal operation is 13%, while the incidence of midline incisional hernia is up to 20% [7,8]. Incisional hernia affects the respiratory, circulatory, intestine, digestive system and causes aesthetic complaints. Surgery is the only treatment method for incisional hernia. Traditional open repair surgery has disadvantages such as big trauma, postoperative complications and high recurrence rate [9-11]. In contrast, LIHR has advantages such as small trauma, less complications and good postoperative recovery, and has been widely used recently [1]. However, operation time and length of stay for patients undergoing LIHR vary significantly due to individual differences.

In this study, we enrolled more female patients than male patients, with an average BMI>30 and the incidence of postoperative complications was 19.51%. These results are consistent with other reports [12]. In this study, in DOS>120 min group 57.9% patients had multiple hernia and recurrent hernia, 78.9% patients had defect diameter>8 cm, and 73.7% patients had patch>300 cm<sup>2</sup>. These proportions were higher than in DOS<120 min group. However, the gender, age, BMI, complications, and duration of disease showed no significant differences in the two groups. Regression analysis showed that multiple hernia, recurrent hernia and patch enlargement were important factors to cause longer DOS. Several reasons may explain our findings. First, for ideal incisional hernia repair, patch should cover the defects and over the edge of 3-5 cm to reduce tension, which is the key to reducing the recurrence of incisional hernia [13]. Complex incisional hernia has large defects and irregular margins, increasing the difficulty of placing the patch and operation time. Second, complex incisional hernia is prone to infection, which increased the risk of intraoperative intestinal injury [14,15]. In this study, one patient had inadvertent bowel injury during surgery, DOS was 240 min and LOS was 15 days, much longer than the average.

In addition, the proportions of patients aged>55 years, with multiple hernia, recurrent hernia, defect diameter>8 cm, patch area>300 cm<sup>2</sup>, DOS>120 min in LOS>5 day group were

significantly higher than in those in LOS<5 day group. Advanced age, the enlargement of patch and prolonged DOS were risk factors to cause prolonged LOS. These may be explained as follow. First, complex incisional hernia surgery causes big trauma and patients need a longer time to recover bowel function, especially for elderly patients. Second, intraoperative intestinal injury increases the incidence of postoperative complications [16]. Third, placing and fixing of patch will damage the surrounding tissues and cause the release of large amounts of inflammatory cytokines, resulting in acute inflammation. The larger the patch, the more severe inflammation, and the longer time of postoperative ileus. Fourth, the longer duration of anaesthesia, the slower of postoperative recovery. Akinci et al. found that for each extended 30 min of DOS, LOS would be prolonged by 25% [17]. In this study we did not analyse the medication type and dosage for relieving postoperative pain, but it is generally believed that a long and complex surgery increases the incidence of postoperative pain, thus increasing the use of analgesic drugs and delaying the recovery of intestinal function. In this study, the proportion of obesity patients with complications in LOS>5 day group was slightly higher than in LOS<5 day group, but the difference was not statistically significant. It was reported that obese patients had low immunity and slow wound healing and were prone to infection, leading to prolonged LOS [18]. Moreover, patients with complications such as COPD or coronary heart disease and patients with hypoalbuminemia or long-term use of steroids had increased risk of postoperative wound infections and prolonged LOS [19,20].

In summary, patients with multiple, larger and recurrent hernias have longer operative time and hospitalization during LIHR, and should be paid more attention.

### Conflict of Interest

The authors declare no conflict of interest.

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