

Elective incisional hernia repair: lower risk of postoperative wound infection with laparoscopic versus open repair

Serene Si Ning Goh, MMed, Kaushal Amitbhai Sanghvi, FRCS, Aaryan Nath Koura, FRCS, Jaideep Raj Krishna Rao, FRCS, Aung Myint Oo, FRCS

Department of Surgery, Tan Tock Seng Hospital, Singapore

Abstract

Introduction: The superiority of laparoscopic repair over open repair of incisional hernias (IHs) in the elective setting is still controversial. Our study aimed to compare the postoperative outcomes of laparoscopic and open elective IH repair in an Asian population.

Methods: This retrospective study was conducted in an acute general hospital in Singapore between 2010 and 2015. Inclusion criteria were IH repair in an elective setting, IHs with diameter of 3–15 cm, and location at the ventral abdominal wall. We excluded patients who underwent emergency repair, had recurrent hernias or had loss of abdominal wall domain (i.e. hernia sac containing more than 30% of abdominal contents or any solid organs). Postoperative outcomes within a year such as recurrence, pain, infection, haematoma and seroma formation were compared between the two groups.

Results: There were 174 eligible patients. The majority were elderly Chinese women who were overweight. Open repair was performed in 49.4% of patients, while 50.6% underwent laparoscopic repair. The mean operation time for open repair was 116 minutes (116 ± 60.6 minutes) and 139 minutes (136 ± 64.1 minutes) for laparoscopic repair ($P = 0.079$). Within a year after open repair, postoperative wound infection occurred in 15.1% of the patients in the open repair group compared to 1.1% in the laparoscopic group ($P = 0.0007$). Postoperative pain, recurrence and haematoma/seroma formation were comparable.

Conclusion: Elective laparoscopic IH repair has comparable outcomes with open repair and may offer the advantage of reduced postoperative wound infection rates.

Keywords: Elective, incisional hernia repair, laparoscopic, open, postoperative wound infection

INTRODUCTION

Incisional hernias (IHs) are iatrogenic abdominal wall defects that occur in 7.4%–60.0% of patients undergoing surgery. 50.0% of cases are detected within a year of the initial operation.^[1,2] Recent evidence has suggested that laparoscopic repair is a promising alternative to open repair.^[3,4] However, these studies are mostly on Caucasian populations. Our study aimed to compare the postoperative outcomes between laparoscopic and open elective IH repair in an Asian population.

METHODS

A retrospective study was conducted in Tan Tock Seng Hospital, an acute and general hospital in Singapore. Patients who underwent IH repair during the period of 2010–2015

were included. Inclusion criteria were: IH repair in an elective setting, IHs of diameter 3–15 cm^[3,5] and location at the ventral abdominal wall. We excluded patients who underwent emergency repair, those with recurrent hernias and those with loss of abdominal wall domain (i.e. hernia sac containing more than 30% of abdominal contents or any solid organs). All patients had preoperative cross-sectional imaging prior to surgery.

Correspondence: Dr. Serene Si Ning Goh,

Department of Surgery, Tan Tock Seng Hospital, 11 Jalan Tan Tock Seng, 308433, Singapore.

E-mail: serene.goh@mohh.com.sg

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For open repair, the incision was performed over the hernia site. The hernia sac and surrounding fascia were dissected with electrocautery. The hernia sac was reduced and mesh placed using onlay (45%), sublay (40%), underlay (12%) or inlay (3%) methods. The mesh was secured to the fascia with prolene sutures.

For laparoscopic repair, intraperitoneal access was achieved with either the open Hasson, the Veress needle or the optical trocar technique. 3–4 trocars were placed under vision, lateral to the hernia defect, for ergonomic adhesiolysis and positioning of mesh. These trocars usually consist of one 10–122 mm port and 2–3 5 mm ports. Adhesiolysis was performed using a combination of sharp and blunt dissection, to include the entire incision from previous surgery. Prosthetic meshes were shaped to achieve a 3–5 cm overlap around the fascial defect. The mesh was anchored to the abdominal wall using circumferential tacks.

IH repairs were performed by consultant surgeons. All patients received preoperative antibiotics. The decision for the open or laparoscopic approach was based on each surgeon's anticipation of the complexity of the case and comfort level. The type of meshes and planes of mesh placement were based on the discretion of the operating surgeon. Patient demographics, comorbidities, operative details and postoperative outcomes were collected from the hospital's electronic system. Postoperative outcomes within a year such as recurrence, pain, infection, haematoma, seroma formation and reoperation were analysed.

IBM SPSS Statistics version 21.0 (IBM Corp, Armonk, NY, USA) was utilised for data analysis. Parametric data was described with mean and standard deviation, while non-parametric data were presented as median and interquartile range. Categorical data was presented as frequency and percentages. Chi-square test was used to assess for significant differences in outcomes between the two surgical approaches. Continuous variables were analysed with Mann-Whitney *U* test. Multivariate analysis was performed to account for confounding factors. A *P* value < 0.05 was considered statistically significant.

RESULTS

A total of 174 patients with IH repair were analysed. The majority were elderly Chinese women who were overweight. Six elective laparoscopic repairs were converted to open repair due to dense adhesions. Open repair was performed in 86 (49.4%) of patients while 88 (50.6%) underwent laparoscopic repair. The mean age of the patients in the open group was 62.5 ± 13.5 years, as compared to 61.5 ± 13.1 years in the laparoscopic group, (*P* = 0.545). In the open group, 61 out of 86 patients were female, as compared to 66 out of 88 in the laparoscopic group (*P* = 0.465). The average body mass index (BMI) in the laparoscopic and open groups, respectively, was 27.1 ± 5.1 kg/m² and 28.1 ± 5.7 kg/m² (*P* = 0.588).

There were no significant differences in comorbidities and ASA (American Society of Anesthesiology) status between

the groups [Table 1]. The most common previous surgery types in our patients prior to development of IH were gynaecological operations, colonic operations, exploratory laparotomies, appendicectomies and others. The majority of the previous surgeries were performed with an open approach [Table 2]. The most common presenting complaint was an asymptomatic lump in both groups, with 85 (96.6%) in the laparoscopic group as compared to 75 (87.2%) in the open repair group (*P* = 0.003). Patients who underwent open repair more commonly presented with pain than the laparoscopic group (9.3%, *n* = 8 vs. 2.3%, *n* = 2; *P* = 0.003) [Table 3]. Both groups had a similar proportion of patients with irreducible IH; 3 (3.5%) and 1 (1.1%) in the open and laparoscopic groups, respectively (*P* = 0.780).

The mean operation duration for open repair was 116 minutes (116 ± 61) and 139 minutes (136 ± 64) for laparoscopic repair (*P* = 0.079). The mean hernia defect size in the open repair group was 61.6 (interquartile range [IQR] 25–100) cm² as compared to 60.0 (IQR 23–110) cm² in the laparoscopic repair group (*P* = 0.576). There was significantly lower blood loss in the laparoscopic group of 10 (IQR 10–100) mL as compared to 50 (10–150) mL in the open group (*P* = 0.030) [Table 4].

Within a year after IH repair, 13 (15.1%) patients had postoperative infection, as compared to 1 (1.1%) who had laparoscopic repair (*P* = 0.0007). Ten patients in the open group had superficial wound infection as compared to one in the laparoscopic group. Three patients in the open group acquired deep infections, including enterocutaneous

Table 1. Demographics and comorbidities of patients.

Characteristic	No (%) / mean \pm SD		P
	Open (n = 86)	Laparoscopic (n = 88)	
Demographic			
Age (yr)	62.5 \pm 13.5	61.5 \pm 13.1	0.545
Female gender	61 (70.9)	66 (75.0)	0.465
BMI (kg/m ²)	27.1 \pm 5.1	28.1 \pm 5.7	0.588
Ethnicity			
Chinese	56 (64.8)	61 (69.9)	0.527
Malay	15 (17.9)	12 (13.3)	0.443
Indian	5 (6.4)	10 (10.8)	0.234
Eurasian	10 (10.9)	5 (6.0)	0.344
Comorbidity			
Hypertension	21 (24.4)	19 (21.6)	0.738
Diabetes mellitus	23 (26.7)	19 (21.6)	0.427
ASA score			
1	52 (60.5)	60 (68.2)	0.644
2	29 (33.7)	24 (27.3)	0.776
3	5 (5.8)	4 (4.5)	0.545
4	0 (0)	0 (0)	NA

ASA: American Society of Anaesthesiologists, NA: not applicable, SD: standard deviation

Table 2. Type of previous surgery and approach.

Parameter	No. (%)		P
	Open (n=86)	Laparoscopic (n=88)	
Approach			
Open	71 (82.5)	67 (76.3)	0.239
Laparoscopic	15 (17.5)	21 (23.7)	
Type of surgery			
Gynaecology	36 (41.9)	41 (46.6)	0.530
Lower GI surgery	20 (23.3)	17 (19.3)	0.526
Exploratory laparotomy for acute abdomen	15 (17.4)	12 (13.6)	0.488
Appendectomy	7 (8.1)	8 (9.1)	0.823
Upper GI surgery	6 (7.0)	7 (8.0)	0.806
Whipple procedure	2 (2.3)	3 (3.4)	0.183

GI: gastrointestinal

Table 3. Comparison of presenting complaints between elective laparoscopic and open incisional hernia repair.

Presenting complaint	No. (%)		P
	Open (n=86)	Laparoscopic (n=88)	
Lump	75 (87.2)	85 (96.6)	0.003*
Pain	8 (9.3)	2 (2.3)	0.030*
Irreducible	3 (3.5)	1 (1.1)	0.780

*P<0.05 was considered as statistically significant.

Table 4. Comparison of operative factors between elective laparoscopic and open incisional hernia repair.

Operative factor	Mean (IQR)/mean±SD		P
	Open (n=86)	Laparoscopic (n=88)	
Hernia size defect (cm ²)	61.6 (25-100)	60.0 (23-110)	0.576
Operation time (min)	116±61	139±65	0.790
Blood loss (mL)	50 (10-150)	10 (10-100)	0.030*

*P<0.05 was considered as statistically significant. IQR: interquartile range, SD: standard deviation

fistula and intra-abdominal abscesses requiring mesh explantation. There were no deep infections in the laparoscopic group [Table 5]. 6 (6.8%) patients in the open group complained of post-operative pain as compared to 2 (2.3%) in the laparoscopic group; however, this was not statistically significant ($P = 0.148$). There were 9 (10.5%) recurrences in the open group as compared to 10 (11.4%) in the laparoscopic group ($P = 0.531$). Postoperative haematoma and seroma formation were comparable between the two groups, 2 (2.3%) in the open and 4 (4.5%) in the laparoscopic group, respectively ($P = 0.418$).

DISCUSSION

The first case of laparoscopic IH repair was described by LeBlanc and Booth in 1993.^[6] The benefits of laparoscopic

Table 5. Comparison of postoperative outcomes between elective laparoscopic and open incisional hernia repair.

Postoperative outcome	No. (%)		P
	Open (n=86)	Laparoscopic (n=88)	
Infection	13 (15.1)	1 (1.1)	0.0007*
Superficial	10	1	0.0045*
Deep	3	0	NA
Postoperative Pain	6 (6.8)	2 (2.3)	0.148
Haematoma/Seroma	2 (2.3)	4 (4.5)	0.418
Recurrence	9 (10.5)	10 (11.4)	0.531

*Adjusted for variables with $P < 0.05$ in Tables 3 and 4. NA: not applicable

surgery have been evident since its advent, including lower postoperative pain, effectiveness and safety.^[7] It has also been the gold standard for appendectomies and cholecystectomies in the past few decades. To date, there is a lack of consensus on the standard technique for IHs. Reported outcomes were also heterogeneous, with some reporting higher enterotomy rates, postoperative seroma rates and longer operative times with the laparoscopic approach as compared to the open approach,^[8,9] while others reported lower postoperative pain, blood loss and shorter length of stay.^[10,11]

In our study, we found that the average age of our study population was above the age of 60 years, and the average BMI was within the obese category based on the World Health Organization's BMI classification for Singaporeans.^[12] Recent studies have highlighted that old age and high BMI are risk factors for development of IH.^[13-15] Other risk factors include male gender and factors affecting wound healing such as diabetes mellitus, immunosuppression and malnutrition. On the contrary, the majority of the patients in our study were female ($n = 127$, 73%). This could be because the most common initial surgery performed was for gynaecological pathologies.

Interestingly, the operative time was comparable in both groups, contrary to studies reporting significantly longer operative times for the laparoscopic group.^[16] However, the absolute total time of repair in both groups were longer in our study as compared to the study by Eker *et al.*^[3] This could be explained by the larger hernia defect sizes in our study (average size of 60–61.6 cm²) as compared to those in Eker *et al.* (average defect size of 5 cm).^[3] Hernia sizes greater than 15 cm were not included in our study, as there is evidence that these may be better managed with an open technique,^[16] while hernia sizes of less than 3 cm were excluded, as they could be closed primarily with sutures without mesh placement.^[17] In addition, we found that laparoscopic repair had significantly lower operative blood loss in our study. The authors feel that laparoscopic repair allows better visualisation of planes of dissection intra-abdominally as compared to the open approach. Coupled with smaller skin incisions and lesser tissue dissection, these may contribute to lower intraoperative blood loss.

Laparoscopic IH repair was found to be associated with lower rates of postoperative infection in terms of both superficial as well as deep infections. Infections in prosthetic mesh repairs can be catastrophic, requiring explantation or mesh salvage and long-term antibiotics.^[18] Explantation of mesh itself leaves a weakness that predisposes the patient to recurrence of hernia, and long-term antibiotics are not without their side effects. In our study, all three patients with deep infections required readmission for explantation of mesh, drainage of intra-abdominal collections and antibiotics. On the other hand, the laparoscopic group only had one patient with superficial surgical site infection, which resolved with oral antibiotics. The reduction in postoperative infection rates could be related to less tissue dissection and reduced contact between the prosthetic mesh and the patient's skin flora during laparoscopy, since it is introduced intraperitoneally as compared to in the open approach.^[8]

Significantly more patients in the open repair group presented with pain ($n = 8$) as compared to two in the laparoscopic group ($P = 0.030$). The number of irreducible hernias were not significantly more than in the laparoscopic group ($n = 3$ vs. $n = 1$; $P = 0.780$). Preoperative pain may suggest a more complicated IH, such as a larger hernia or the presence of intermittent incarceration or bowel obstruction. In light of this, adjustments for the presence of preoperative pain were made; however, postoperative infection rates remained significantly lower in the laparoscopic repair group ($P = 0.0007$).

The rate of recurrence of IH was 10.5% in the open group and 11.4% in the laparoscopic group, which was comparable with the current literature for both approaches.^[19,20] A randomised clinical trial by Eker *et al.*^[3] reported a recurrence rate of 14% in the open group and 18% in the laparoscopic group but had a longer follow-up duration of 35 months, as compared to the one-year follow-up in our study.

Our study compared the postoperative outcomes between two approaches of IH repair within a year. Given the associations with lower intraoperative blood loss, lower postoperative infection rates and comparable recurrence rates with the literature, the authors are convinced that laparoscopic IH repair is a promising alternative to open repair in an elective setting. The limitations of our study include its inherent retrospective nature, with possible selection bias. There was also lack of standardisation of surgical techniques and a relatively short duration of follow-up for postoperative outcomes. In addition, the sample size of our study was small and derived from a single institute. Future areas of development include embarking on a multi-centre study to compare postoperative outcomes over a longer duration and exploring the role of laparoscopic surgery in emergency surgical repair of IHs.

In conclusion, laparoscopic IH repair has comparable outcomes with open repair and may offer the added advantage of reduced postoperative infection rates and blood loss.

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Conflicts of interest

There are no conflicts of interest.

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