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Early postoperative small bowel obstruction: open vs laparoscopic

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Abstract

BACKGROUND—The window for safe reoperation in early postoperative (<6 weeks) small bowel obstruction (ESBO) is short and intimately dependent on elapsed time from the initial operation. Laparoscopic procedures create fewer inflammatory changes than open laparotomies. We hypothesize that it is safer to reoperate for ESBO after laparoscopic procedures than open.

METHODS—Review of patients who underwent re-exploration for ESBO from 2003 to 2009 was performed. Based on the initial operation, patients were classified as “open” or “laparoscopic.” The Revised Accordion Severity Grading System was used to define complications as minor (1 to 2) or severe (3 to 6).

RESULTS—There were 189 patients identified (age 55 years, 48% male): 130 open and 59 laparoscopic. Adhesive disease was more common (65% vs 42%, $P<.01$), while strictures were less frequent (5% vs 14% $P=.03$), in the open group. The open group had a greater rate of malignancy, days to re-exploration, and severity of complications. There was no difference in the rates of minor complications, enterotomy, and mortality. ESBO after laparoscopic surgery was more commonly caused by a focal source (85% vs 63%). Eighty-three patients (64 open, 19 laparoscopic) underwent re-exploration at or beyond 14 days. Within this subgroup, there were more severe complications (25% vs 5%) after open procedures with equivalent mortality (4% vs 0%).

CONCLUSIONS—Laparoscopic approaches confer a lower rate of adhesive disease and severity of complications in early SBO as compared with open surgery even if performed after 2 weeks of index procedure.

Keywords

Small bowel obstruction; Laparoscopic surgery; Open surgery

Early postoperative small bowel obstruction (ESBO) is a challenging complication after abdominal operations, which leads to significant morbidity and a correspondingly high rate

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of mortality.¹⁻⁶ ESBO after open surgery is commonly because of adhesions. In this setting, nonoperative management with gastric decompression can be effective.⁴ The benefits of the nonoperative management must be weighed, however, against the risk of reoperation. This decision is intimately tied with the duration of time after the index operation, given the development of dense, inflammatory adhesions by 10 to 14 days. These adhesions contribute to an operative milieu where it is difficult to discern appropriate anatomy thus increasing the risk for iatrogenic injuries.⁷

Surgical dictum suggests that reoperation beyond the 14-day window is unsafe. Laparoscopic procedures generate fewer adhesions of this nature. Despite this, ESBO still occurs.⁷ With the increasing ability to perform even the most complicated procedures laparoscopically, it is uncertain whether the difference in etiology of ESBO between the operative approaches increases or eliminates this time for safe reoperation after laparoscopic abdominal operations.⁸ Therefore, we aimed to explore the safety of reoperation for ESBO with specific emphasis on the nature of the index operation as well as the ESBO etiologies and outcomes. We hypothesized that patients who had an initial laparoscopic operation developed fewer adhesions with correspondingly improved outcomes after re-exploration for ESBO as compared with those undergoing an initial open initial operation.

Patients and Methods

Institutional Review Board approval was obtained to retrospectively study all patients diagnosed with ESBO (≤ 6 weeks from index abdominal operation) who underwent re-exploration from January 2003 to May 2009. Patients with postoperative ileus, younger than 18 years of age, or with ESBO that resolved without operative intervention were excluded.

Patients were considered to have ESBO if they had abdominal pain/distension plus nausea/vomiting or required insertion of a nasogastric tube for decompression within 6 weeks of an abdominal operation (laparotomy/laparoscopy) with concurrent computed tomography signs of distended small bowel and a transition point or plain radiographic imaging with a lack of colonic gas. Those patients who did not have imaging before the re-exploration were diagnosed with ESBO if operative findings confirmed ESBO. Postoperative ileus was differentiated from ESBO by the lack of a transition point on computed tomography or the presence of colonic gas on radiographic imaging. Comparisons between variables were performed based on the type of the index operation (laparotomy vs laparoscopy). Robotic and laparoscopic hand-assisted surgeries were considered in the laparoscopic group, while a laparoscopic index procedure converted to an open operation was considered in the laparotomy group. Index operation was classified into either upper gastrointestinal (esophageal, gastric, pancreatic, hepatobiliary, small intestine, or bariatric) or pelvic surgery (colorectal or gynecologic). The decision of whether to perform the initial surgery as open vs laparoscopic was based on the discretion of the primary surgeon.

Operative reports were reviewed to identify the etiology of obstruction and were grouped into adhesive, internal hernia, external hernia, volvulus, stenosis, and malignant obstructions. The focality of the adhesive process, also obtained from the operative records, was dichotomized into localized or diffuse processes. Localized adhesions included single bands

of adhesions causing a loop of bowel to be kinked or acutely angulated, while widespread adhesions included a more diffuse process. The term “active malignancy” was used to define patients who underwent oncologic surgery as their index surgery. The severity of complications was classified based on the Revised Accordion Severity Grading System.⁹ Grade 1/2 complications were considered minor, while grade 3 or greater was considered severe. Mortality was defined as in hospital or within 30 days of the re-exploration. Early re-exploration was defined as exploration within 13 days of the index operation, while late re-exploration was defined as exploration from day 14 or later from the index operation. A subgroup analysis was performed comparing the outcomes of patients in the late group.

Continuous variables are presented as medians with interquartile range and compared using the Wilcoxon 2-sample test. Categorical variables are presented as percentages and analyzed using the Fisher’s exact test. Statistical significance was defined as *P* value less than or equal to .05.

Results

During the study period, 7,223 laparoscopic and 3,066 open surgeries were performed. One hundred and eighty-nine patients were identified (48% male) with a median age of 56 years (range 18 to 93). One hundred and thirty patients had an open index operation, while the remaining 59 patients initially underwent a laparoscopic operation. Patients in the open group were older (57 years [47 to 67] vs 50 years [33 to 67] years, *P* = .02) than patients in the laparoscopic group with a higher percentage of men (54% vs 36%, *P* = .02). There was no difference in the profile of comorbidities between the 2 groups save for a greater incidence of coronary artery disease (15% vs 3%, *P* = .02) and active malignancy (42% vs 12%, *P* < .01) in the open group (Table 1). No difference was noted in the percentage of pelvic operations between the 2 groups (56% vs 54%). The incidence of bowel resection in the index procedure was similar in both groups (49% vs 53%).

Patients in the laparoscopic group were diagnosed with ESBO earlier (7 days [4 to 11] vs 9 days [6 to 15], *P* = .03) and underwent earlier re-exploration (10 days [6 to 14] vs 13 days [9 to 20], *P* = .02) than patients in the open group. Regarding the etiology of the ESBO, patients with an open index operation had a higher incidence of adhesive obstruction (65% vs 42%, *P* < .01) as opposed to a greater incidence of strictures in the laparoscopic group (5% vs 14%, *P* = .03). Laparoscopic operations also resulted in a more focal nature of obstruction as compared with the open group (63% vs 85%, *P* < .01); however, there was a similar rate of external herniation (27% vs 16%, *P* = .08; Table 2).

Patients in the open group had a longer duration of stay in the hospital after the second operation (10 days [7 to 16] vs 9 days [5 to 13], *P* = .03) than patients in the laparoscopic group. Although there was no statistical difference in the overall rate of complications (42% vs 33%, *P* = .35), patients undergoing laparotomy had a greater incidence of severe complications (24% vs 10%, *P* = .03). Both overall and duration of total parenteral nutrition use after re-exploration was greater after an open operation (68% vs 52%, *P* = .03 and = days [0 to 9] vs 3 days [0 to 6], *P* = .05, respectively; Table 3).

The majority of re-explorations in the open group were performed in an open fashion (96%), whereas 25% of the re-explorations in the laparoscopic group were successfully completed laparoscopically. Eight percent of the patients converted to an open procedure intraoperatively (Table 4). Most of the re-explorations occurred within 13 days after the index operation but re-explorations persisted throughout the 6-week study period (Fig. 1). Infectious complications dominated the postoperative morbidities in the whole cohort (Fig. 2).

One hundred and six patients were re-explored within 13 days (early group), while 83 patients were re-explored between 14 and 42 days. There was no difference in outcomes between the 2 groups except for a higher incidence of serosal tears in the late group (Table 5). From the late group, 64 patients had an open index operation and 19 were laparoscopic. No difference was noted in outcomes between these 2 subgroups save for a higher incidence of severe complications in the open group (25% vs 5%, $P = .05$). Fig. 3 shows the distribution of our cohort along with the outcomes of each individual group.

Comments

The development of postoperative adhesions is almost inevitable making the decision to re-explore in the early postoperative period a cautious one. Beyond the 2-week mark, these adhesions develop into dense, hypervascular adhesions creating a hostile milieu with an increased risk of bowel injury during re-exploration.^{10,11} Laparoscopic surgical techniques provide a less invasive approach with correspondingly reduced trauma to the bowel and associated tissues thereby creating fewer intraperitoneal adhesions.¹² These techniques potentially create a more favorable intra-abdominal environment for re-exploration in the early postoperative setting.

ESBO is a challenging problem for both the patient and the surgeon. It is defined variably in the literature with an incidence varying between .7% and 9.5%.^{13,14} Its presentation in the postoperative setting creates a situation in which it is hard to distinguish ESBO from benign, self-resolving, postoperative ileus. This is a critical decision point as the treatments differ with an 8% to 9% risk of strangulation for ESBO.^{15,16}

With the advances in minimally invasive surgery, laparoscopic and robotic surgery has been shown to have similar, and sometimes better, postoperative outcomes. Nowadays, its use has been expanded to perform even the most complex procedures. Laparoscopic Roux-en-y gastric bypass has been shown to have similar weight reduction effects to the open counterpart but with a more superior postoperative course and improved complication profile.^{17,18} Correspondingly, laparoscopic distal pancreatectomy/splenectomy has been shown to be an equivalent alternative to the open technique with a shorter postoperative course and reduced intraoperative blood loss.^{19,20} Even laparoscopic Whipple procedures, in experienced hands, is a safe option with similar outcomes to its open counterpart.²¹ With the rise in minimally invasive surgical procedures, the need to re-explore patients in the early postoperative period for ESBO has increased. Duron et al⁷ reported a .2% rate of SBO after laparoscopic surgery with a vast majority (88%) presenting in the early postoperative period.

Port site hernia was attributed as an important cause of ESBO surgery irrespective of closing the facial defect or keeping it open.^{22,23}

In this study, we observed that ESBO in the laparoscopic group was caused by a more focal disease process manifested by the higher incidence of stenosis, external hernia, and localized adhesions. Despite both groups having no statistical difference in the rates of enterotomies and serosal tears, patients with an index laparoscopic surgery had a more benign postoperative course, which was associated with less frequent development of severe complications. When comparing the outcomes of patients who were explored in the early vs late postoperative period, there was no difference in outcomes except for a higher incidence of serosal tears in patients who were explored in the late group. This could be explained by the development of denser adhesions making intraoperative dissection more difficult. But this was not reflected in any difference in postoperative complications or duration of hospital or intensive care unit stay. In comparing outcomes of the late group, patients with an open index surgery developed higher incidence of severe postoperative complications. In our series, the postoperative complications were mostly infectious in nature with approximately one quarter of the patients developing a postoperative wound infection.

Our study has limitations. Because of the retrospective nature of the study, we could not draw a cause and effect relationship between the nature of the index operation and the outcomes after re-exploration. Certainly, the greater rate of malignancy, chronic kidney disease, and coronary artery disease in laparotomy patients implies that this patient population had correspondingly worse comorbidities and hence probably severe complications. Second, the low number of patients with an index laparoscopic surgery compared with the open group likely created type II error. This was compounded in the subgroup analysis of the patients undergoing re-exploration after 13 days.

Causes of ESBO after laparoscopic surgery were more localized in nature when compared with open procedures. While care must be taken in any re-exploration situation, our results imply that late re-explorations after an initial laparoscopic operation carry less severe postoperative complications as compared with open surgery.

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Figure 1.

Total number of re-explorations per postoperative week in open and laparoscopic groups.
(For interpretation of the references to color in this Figure, the reader is referred to the web version of this article.)

Figure 2.
Number of patients with individual complications. (For interpretation of the references to color in this Figure, the reader is referred to the web version of this article.)

Figure 3. Distribution and outcomes of each group. (For interpretation of the references to color in this Figure, the reader is referred to the web version of this article.)

Table 1

Patient demographics and comorbidities

Feature	Open (<i>n</i> = 130)	Laparoscopic (<i>n</i> = 59)	<i>P</i> value
Age	57 (47–67)	50 (33–67)	.02
Sex (male)	54%	36%	.02
Comorbidities			
Hypertension	43%	36%	.33
DM	12%	10%	.67
CAD	15%	3%	.02
CHF	3%	2%	.58
COPD	5%	0%	.09
Liver disease	8%	2%	.10
CKD	12%	2%	.02
Active malignancy	42%	12%	<.01
Immunosuppression	23%	20%	.67
Crohn's disease	2%	3%	.67
Known hernia	13%	10%	.57

Data are presented as percentages and medians with interquartile ranges.

CAD = coronary artery disease; CHF = congestive heart failure; CKD = chronic kidney disease; COPD = chronic obstructive pulmonary disease; DM = diabetes mellitus.

Table 2

Etiology of early postoperative obstruction

Etiology of obstruction	Open (n = 130)	Laparoscopic (n = 59)	P value
Adhesions	65%	42%	<.01
External hernia	16%	27%	.08
Internal hernia	8%	10%	.57
Volvulus	5%	7%	.54
Stenosis	5%	14%	.03
Malignant obstruction	1%	0%	.34
Focal adhesions	63%	85%	<.01

Data are presented as percentages

Table 3

Outcomes after the second operation

Outcomes	Open (<i>n</i> = 130)	Laparoscopic (<i>n</i> = 59)	<i>P</i> value
Days to diagnosis	9 (6–15)	7 (4–11)	.03
Days to re-exploration	13 (9–20)	10 (6–14)	.02
Duration of stay after the second operation	10 (7–16)	9 (5–13)	.03
ICU duration of stay	0 (0–1)	0 (0–0)	.09
Complications	42%	33%	.35
Minor complication	18%	23%	.40
Severe complication	24%	10%	.03
Strangulation obstruction	2%	7%	.21
Serosal tear	24%	32%	.23
Enterotomy	12%	7%	.31
Enterocutaneous fistula	2%	0%	.24
TPN use post re-exploration	68%	52%	.03
Days of TPN post re-exploration	5 (0–9)	3 (0–6)	.05
Re-re-exploration	6%	7%	.87
Persistent SBO at 6 weeks	8%	0%	.03
Mortality	5%	0%	.09

Data are presented as percentages and medians with interquartile ranges.

ICU = intensive care unit; SBO = small bowel obstruction; TPN = total parenteral nutrition.

Table 4

Status of the second operation

Status of the second operation	Open (<i>n</i> = 130)	Laparoscopic (<i>n</i> = 59)	<i>P</i> value
Open	96%	66%	<.01
Laparoscopic	2%	25%	<.01
Laparoscopic converted to open	2%	8%	.02

Table 5

Outcomes of patients with early (≤ 13 days) and late (>13 days) re-exploration

Feature	Early (<i>n</i> = 106)	Late (<i>n</i> = 83)	<i>P</i> value
Complications	41%	37%	.76
Minor complications	28%	24%	.62
Severe complications	12%	13%	.83
Serosal tear	22%	32%	.10
Enterotomy	5%	17%	.01
Re-re-exploration	6%	6%	.77
Duration of stay post second operation	11 (7–15)	10 (7–15)	.37
ICU duration of stay	0 (0–1)	0 (0–0)	.25
TPN use post re-exploration	61%	63%	.76
Days of TPN post re-exploration	4 (0–9)	5 (0–8)	.90
Mortality	4%	2%	.70

Data are presented as percentages and medians with interquartile ranges.

ICU = intensive care unit; TPN = total parenteral nutrition.