SCIENTIFIC PAPER

Laparoscopic Management as the Initial Treatment of Acute Small Bowel Obstruction

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ABSTRACT

Objectives: We prospectively evaluated our experience with laparoscopic management of acute small bowel obstruction (SBO).

Methods: The study group included all patients requiring surgical intervention based on complete mechanical SBO by clinical assessment or who had failed conservative management. Patients with malignant causes were excluded. Experienced laparoscopic surgeons performed all operations.

Results: Between January 1998 to January 2003, 61 patients required operative intervention for acute SBO. Causes included adhesions, internal hernia, incarcerated incisional hernia, and inflammatory bowel disease. Laparoscopic techniques (LAP) alone were successfully used to complete 41 cases (67%). Twenty patients (33%) were converted (CONV) to either mini-laparotomy [7 patients (35%)] or standard midline laparotomy [13 patients (65%)]. A single band was identified in 25 patients (41%). Complications occurred in both groups.

Conclusions: We believe all patients requiring surgery in the setting of acute small bowel obstruction should undergo a laparoscopic approach initially. By specifically identifying those patients with a single band as the cause of obstruction, a significant number of patients will be spared a large laparotomy incision. Conversion should not be viewed as failure, but rather, a sometimes necessary step in the optimal management of these patients.

Key Words: Small bowel obstruction, Laparoscopy, Adhesions.

INTRODUCTION

Laparoscopic management of acute small bowel obstruction has been shown to be feasible and advantageous.[1,2] However, widespread acceptance and application is still not observed.[3] Most published articles place emphasis on whether a procedure can be completed laparoscopically. There is a tendency, in the literature, to define an operation as "successful" if it is not converted. We recommend that surgeons alter their perspective and view laparoscopy as an initial step in the optimal management of acute small bowel obstruction.

No preoperative test is available that will clearly identify those patients who will benefit from laparoscopic techniques. Obviously, those patients with single adhesion bands can only be spared unnecessary midline incisions by identifying them with an initial laparoscopic approach. Benefits include shorter operative times, less adhesion formation, fewer wound complications (infection/hernia), quicker recovery, shorter hospital stay, and less pain.[1–30] Thus, these patients should be directed to experienced laparoscopic surgeons for optimal management. The purpose of this study was to prospectively evaluate our experience with laparoscopic management of acute small bowel obstruction to identify indications and establish an optimal operative strategy.

METHODS

We prospectively followed 61 consecutive patients who presented with acute small bowel obstruction and required surgical intervention between 1998 and 2003. All patients presented with signs and symptoms of acute small bowel obstruction. Patient ages ranged from 21 to 95 years. There were 23 males and 38 females in the study group. All patients failed a trial of conservative management and underwent a gastrograffin small bowel series, a computed tomographic (CT) scan of the abdomen and pelvis, or both of these. Results for all patients were consistent with a "high grade" or complete mechanical obstruction. Exclusion criteria included free air and evidence of malignant causes of obstruction, ie, recurrent cancer and carcinomatosis. These patients underwent standard midline exploration without a trial of laparoscopy.

The operative technique was similar among study surgeons. After induction of general endotracheal anesthesia, patients were placed in the supine position with both arms placed by their sides if possible. An electrical bed that allows maximal tilting of the patient in all directions is vital and was used. Tilting of the table allows the use of gravity to assist in manipulation of the bowel. Typically, the heavier, distended bowel will fall away from the laparoscope field of vision. Monitors were placed on each side of the table to facilitate shifts in the procedure from quadrant to quadrant. Nasogastric and urinary catheters were placed routinely if not already in place. A prophylactic antibiotic was administered preoperatively.

Peritoneal access techniques vary in this setting.[1–9,11–31] In our study, a Veress needle was typically placed in the left upper quadrant, away from surgical scars, to establish pneumoperitoneum. This is generally an area free of adhesions except in patients who had prior left upper quadrant surgery. For example, in a patient with prior splenectomy, the right upper quadrant is chosen for Veress needle insertion. If unsuccessful, a Hassan or open technique was used. If open access was not possible, the operation was converted to open. As an alternative to the Veress needle, a bladeless trocar with laparoscopic visualization was used.

The remaining operative trocars were then inserted under direct vision. Typically, three 5-mm trocars were used. An additional fourth 5-mm or 12-mm trocar could be inserted as clinically indicated to assist with retraction or insertion of a stapling devise or clip applier. Some variability exists in trocar placement. Whenever possible, trocars are placed away from the site of interest to triangulate with the camera. A 5-mm, 30-degree angled laparoscope was used in all cases. Optimal placement of trocars was individualized, and the most commonly used arrangements are pictured **(Figure 1)**. When the distal ileum is suspected to be the site of transition,

left lateral port site placement **(Figure 1B)** seems to be the most appropriate. As with all laparoscopic procedures, some flexibility and improvisation is necessary.

An initial assessment is made to determine the likelihood of successful laparoscopic management. The extent of adhesions encountered after initial insertion of the laparoscope is extremely variable. Adequate visualization is obtained by varying degrees of adhesiolysis. The next step, when possible was identification of decompressed bowel. When a single band was identified with a clear transition zone, the band was lysed and the operation was concluded **(Figure 2)**. If an abnormal loop of bowel was identified, this became the focus of attention. Identification of nonviable bowel necessitated conversion to either "mini-lap" (a small, directed incision placed directly over the pathology and typically less than 10 cm) or midline exploration. When the transitional zone was not clearly identified, the bowel was "run" using a "grasper over grasper" technique, typically from ileocecal junction to proximal jejunum. Running the bowel, in the opposite direction, from the ligament of Treitz to the cecum was also utilized, as was a combination of both approaches. Care was taken to gently manipulate the bowel. Grasping the bowel wall itself was avoided, as much as possible, and grasping only mesentery or simply pushing the bowel was preferred to avoid iatrogenic injury. Serosal tears and minor injuries with only minimal spillage were repaired with laparoscopic suturing techniques. If gross spillage occurred or surgical judgment suggested it was unsafe to proceed laparoscopically, the case was converted to either a "mini-lap" or a midline laparotomy. A "directed" incision or "mini-lap" was also used in cases where there was suspicion of compromised bowel, uncertain diagnosis, iatrogenic injury, or when there was doubt that complete resolution of the obstruction
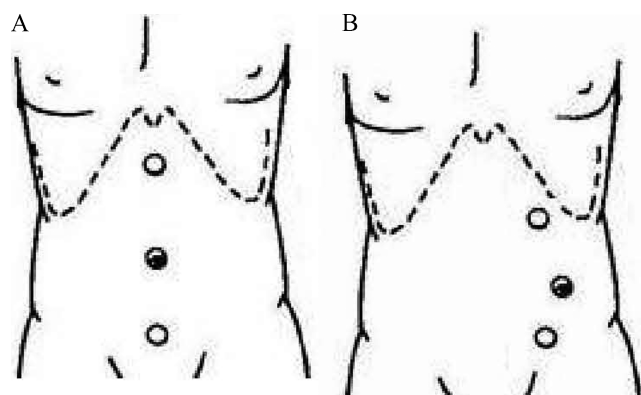
Figure 1. Optimal trocar placement sites.

Figure 2. Laparoscopic lysis of a single band.

had been achieved. We believe a small directed incision is still more advantageous than a standard midline laparotomy.

A single band was the most common cause of small bowel obstruction (SBO) in our study group. Identifying dilated and decompressed bowel aided in locating the "transition zone" and the culprit adhesive band. During the process of "running" the bowel, resistance or difficulty in pulling the bowel was typically encountered when the point of obstruction was near. If a transition zone was identified, successful laparoscopic management was much more likely.

Lysis of adhesions can be safely performed with the use of laparoscopic scissors. Thick adhesions are usually avascular and do not necessarily require bipolar cautery, surgical clips, or stapling devices for transection. Upon relief of the obstruction, the entire small bowel was re-examined for signs of intestinal injury, other sites of obstruction, or both of these. It is not necessary to lyse all adhesions if a transition zone is clearly identified.

Statistical Methods

Data were analyzed using SAS version 8.2 (SAS Institute Inc., Cary, NC). Graphs were generated from Microsoft Excel 2000 (Microsoft Corporation, Redmond, Washington). All patients were considered for analysis. Analysis of statistically significant differences was performed using a single sample t test. $P \leq 0.05$ was considered to have statistical significance.

RESULTS

Sixty-one patients who presented with acute small bowel obstruction and failed conservative management under-

went initial laparoscopy. Of these, 41 (67%) had definitive, completely laparoscopic treatment (LAP). Of the remaining 20 (33%) converted (CONV) patients, 7 (35%) were treated by "mini-lap," and 13 (65%) had conventional midline laparotomies. Reasons for conversion included massive or dense adhesions, ischemic bowel, iatrogenic enterotomy, and technical difficulties.

Fifty-two patients (85%) had prior abdominal surgery. **Table 1** summarizes the distribution of these patients and the number of prior abdominal operations. Nine patients (15%) had no prior abdominal surgery and none of them required conversion to a midline laparotomy. However, four patients (40%) required mini-lap. The group of patients with only 1 prior operation represented the largest percentage of those treated "successfully" with completely laparoscopic management. 29 out of the 33 patients (87%) with 1 prior operation were treated laparoscopically without conversion to laparotomy. The past surgical history for this group consisted of: appendectomy, 9 (31%); colectomy, 9 (31%); hysterectomy, 7 (23%); splenectomy, 2 (7.5%); and gastric bypass, 2 (7.5%). **Table 1** also shows the distribution of the patients that had single bands in relation to the number of prior operations. The majority of the single band patients had 2 prior operations. This does not prove to be statistically significant.

The etiology of small bowel obstruction in this series is shown in **Table 2.** A single adhesive band accounted for 41% (25 patients) of the cases. Multiple adhesions were found in 16 patients (26%). Incarcerated ventral hernia was the cause in 6 patients (10%) and internal hernia was identified in 2 patients (3%). Incarcerated trocar site hernia

Table 1.
Number of Previous Abdominal Operations (n = 61)

Previous Abdominal Operations	Number of Patients (%)	Conversion to Mini-lap/Midline	Laparoscopy Only	Single Band
None	9 (15%)	4 (40%)	5 (60%)	6 (24%)
1 operation	33 (54%)	4 (13%)	*29 (87%)	6 (24%)
2 operations	14 (23%)	9 (64%)	5 (36%)	11 (44%)
≥3 operations	5 (0.8%)	3 (60%)	2 (40%)	2 (8%)
Total	61 (100%)	20 (33%)	41 (67%)	25 (100%)

*Mean number of previous surgeries = 1.31 (range: 0 to 3).

†Mean number of previous surgeries = 2.33 (range: 0 to 7).

‡$P = 0.0297$ (statistically significant).

§Prior surgeries included: appendectomy (9 [31%]); colectomy (9 [31%]); hysterectomy (7 [23%]); splenectomy (2 [7.5%]), gastric bypass (2 [7.5%]).

Table 2. Etiology of Small Bowel Obstruction	
Cause of Obstruction	Number of Patients (%)
Single adhesion band	25 (41%)
Multiple adhesions	16 (26%)
Incarcerated ventral hernia	6 (10%)
Internal hernia	2 (3%)
Incarcerated trocar site	2 (3%)
Inflammatory bowel disease	2 (3%)
Anastomotic leak	2 (3%)
Diverticulitis	2 (3%)
Incarcerate inguinal hernia	1 (1.6%)
Small bowel tumor	1 (1.6%)
Radiation injury	1 (1.6%)
Pelvic recurrence	1 (1.6%)
Total	61 (100%)

Table 3. Morbidity and Mortality		
Complication	Laparoscopy	Converted
Access injury	0	0
Enterotomy	4	3
Wound infection	0	2
Incisional hernia	0	2
Bleeding	0	0
Recurrence	0	1
Pneumonia	0	1
Death (30 day mortality)	0	0

was found in 2 patients (3%). Neoplasia, anastomotic leak, diverticulitis, incarcerated inguinal hernia and inflammatory bowel disease accounted for the remaining etiologies.

Patients in the LAP group had a significantly shorter length of hospital stay (3.9 days) compared to those patients who were converted to either "mini-lap" (8.85 days) or midline laparotomy (11 days), $P = 0.0003$.

Mean operative time for LAP patients was 59 minutes (range 12–135). Mean operative time for CONV patients was 97 minutes (range 49–140). Patients who had a single band as the cause of the SBO had a mean operative time of 39 minutes (range 12–60). This was significantly less than the mean operative times for LAP and CONV procedures individually. In the group of patients with a single band as the primary cause of the SBO, there were no conversions to an open midline procedure and only four conversions to "mini-lap." In these mini-lap cases, a small directed incision was performed over the site of pathology. Typically, the pathology was associated with either bowel necrosis, questionable viability of the bowel, or feared iatrogenic injury.

Complications are summarized in **Table 3** and included a total of 4 enterotomies in 3 patients during laparoscopy and 3 enterotomies in 3 patients during open lysis of adhesions. There were two wound infections and two ventral hernias in the CONV group. No wound infections or port-site hernias were identified in the LAP group. No patients died in the 30 day postoperative period. No wound complications were

noted in the LAP group for the study follow-up period. One patient in the CONV group failed to resolve the obstruction and was returned to the operating room for a second midline exploration in the early postoperative period. Although prolonged ileus was encountered frequently even after successful laparoscopic management, no patients from the LAP group required re-operation. During the study period, one LAP patient and one CONV patient had readmission to the hospital for recurrent partial SBO, but resolved with conservative measures. The patient from the CONV group has had nine admissions for recurrent partial SBO, but has not required re-operation. The mean time of follow up for the group is 20 months.

We reviewed the studies that reported experience on at least 30 patients with acute SBO that were approached laparoscopically; and that clearly reported etiologies of obstruction, the percent due to a single adhesive band, and conversion rates. Our findings are shown in **Table 4.** Adhesions were the most common etiology of acute SBO in all the studies. Furthermore, a single (isolated) band was the most common etiology encountered overall. A high "success" rate (65–84%) was reported in these patients with a single band etiology.

DISCUSSION

Fischer[13] reviewed 14 reports with a total of 918 patients describing attempted laparoscopic approach to SBO. The mechanism of obstruction was classified into the following categories: isolated bands (43.3%); dense adhesions (28.2%); internal hernia (9.85%); other (18.65%). Successful laparoscopic approach was obtained in 68% of cases from the 14 studies. Our study demonstrated similar results. We found isolated bands in 41% of the cases. The majority were treated

Table 4.
Reports* of Laparoscopic Adhesiolysis for Isolated (Single) Band

First Author	Study Year	Number of Patients	% Patients With Single Band (n)	% Lap Success for Patients With Single Band (n)
Ibrahim	1996	33	69.7% (23)	78% (18)
Luque-de Leon	1998	40	15% (6)	83% (5)
Strickland	1999	40	30% (12)	75% (9)
Suter	2000	83	42.4% (35)	68% (24)
Chosidow	2000	134	30.6% (41)	Not reported
Levard	2001	308	54% (166)	65% (109)
Present series	2005	61	41% (25)	84% (21)
Total/Mean %		699	40.4%	75.5%

*Only studies with > 30 patients included.

laparoscopically with short operative times. Only four patients required conversion to "mini-lap". Dallemagne et al[12] reported similar results in their series.

Despite numerous articles demonstrating the high success rate of laparoscopic management of acute small bowel obstruction, the laparoscopic approach has not gained acceptance among most general surgeons. Possible reasons include: cost issues, operating room logistic issues, fear of having to convert to open, concern with distended bowel, iatrogenic injury, misconceptions, skepticism that benefits outweigh risks, and lack of training and experience.

As surgeons, we are trying to achieve an optimal management of the SBO patient. Laparoscopy is an option in this process. Even if its only function is to identify those patients who have a single adhesive band, the technique has significant value. Furthermore, it is the single most common etiology of SBO reported in the studies reviewed **(Table 4).** Twenty-one of 25 (84%) patients were managed laparoscopically. The other 4 patients had a "mini lap." About 50% of patients with acute SBO have a single adhesive band as the etiology.[10,27] The advantage of sparing some patients a midline incision with its associated complications (wound infection, hernia, adhesions) is difficult to measure, but obviously significant. We disagree with those authors that propose a randomized, prospective study to compare open vs laparoscopic approaches. We need to demonstrate that patients that undergo a laparoscopic approach fair better than those that undergo an open approach with no higher incidence of complications. This information is already evident in the published literature.[2–5,8–14,16,18–20,23,25,27,28] No study, to date, has shown a disadvantage to laparoscopy as the initial step. We suggest that laparoscopy should be attempted first to identify those patients who have a single band or an etiology that lends itself to the laparoscopic approach. Less emphasis should be placed on the fear of conversion; and laparoscopy should be incorporated into the algorithm for these patients.

We studied the effect of prior operations on the ability to treat without the need for conversion. Patients with 1 prior operation were the least likely to require conversion in our study group. In this group, prior operations included: appendectomy, colectomy, hysterectomy, splenectomy, and gastric bypass. From the data in **Table 1**, we infer that the type of operation is less important than the number of prior operations. We were still able to successfully treat patients with multiple prior operations. Surgeons can use the past surgical history as a guide, however multiple prior operations should not deter from a laparoscopic approach.

The surgeon needs to assess the likelihood of successful laparoscopic management early on. In cases of an isolated band, we followed this systematic approach. To do so, one should quickly identify dilated and decompressed bowel. If an abnormal loop of bowel is identified, this should be the focus of attention. The bowel is "run" grasper over grasper, typically from the ileocecal junction proximally. Resistance usually identifies the point of obstruction or the "transition zone." Finally, adhesiolysis of the band(s) is performed. If a transition zone was identified, successful laparoscopic management is more likely. If the above steps do not occur smoothly, a "mini-lap" or full conversion is likely. There does appear to be a learning curve, and during this learning curve the ability to quickly assess when conversion is necessary is acquired.

Reasons for conversion in our study included iatrogenic perforation, non-viable intestine identified at laparoscopy, inability to identify the obstruction site, and poor progress. Several authors have reported similar reasons.[2–5,8–14,16,18–20,23,25,27,28,30] Converted patients do not necessarily have a worse prognosis than LAP patients.[10] In fact, we contend that conversion does not equal failure, but simply the necessary sequence of events in the optimal management of these patients. The goal is to identify those patients with a single band and treat them efficiently with an initial laparoscopic approach.

Prolonged ileus is not completely avoided in the laparoscopic approach. It is a consequence of the duration of the obstruction and bowel distention, i.e. the severity of disease. The high frequency with which ileus is encountered in this clinical setting may seem to negate the advantages of the laparoscopic approach. We argue that other advantages are significant and include fewer complications, such as hernia, wound infection, and possibly even less adhesion formation.[10,16]

Most series reveal no difference between open and laparoscopic groups with respect to iatrogenic injuries to bowel.[10] In our series, iatrogenic perforations occurred in both open and laparoscopic procedures. In general, iatrogenic injuries were more likely with dense and extensive adhesions. Although we try to avoid perforations by using atraumatic forceps, pushing instead of grasping, and avoiding direct grasping of serosa, they do occur occasionally. Just as when a perforation occurs in a conventional procedure, all necessary steps are taken to repair it. However, we cannot overemphasize the danger of undetected injury which manifests postoperatively. Deaths have been reported from missed iatrogenic perforations during adhesiolysis for laparoscopic ventral hernia repair and in the management of small bowel obstruction.[19] The surgeon must take every possible precaution to avoid this complication.

Patients with evidence of malignant obstruction should undergo open midline laparotomy, initially. Our own early experience (not reported) showed that patients suspected of having SBO secondary to a malignant process had a 100% conversion rate. This was primarily due to more complicated pathology. The obstruction was not due solely to adhesions, but, rather, from tumor invasion and bulk. Thus, patients are likely to need small bowel resections or bypass procedures which are prohibitively complex procedures to perform laparoscopically in acute settings. Contrary to this, Rosin et al. reported 5 out of 8 patients with malignancy had adhesions (two, a single band) as the cause of obstruction and did not require conversion to open.[25] Thus, we are not opposed to a policy of laparoscopy in all patients with acute small bowel obstruction as an initial step. Diagnostic modalities allow for accurate selection of those patients with advanced malignancy that are unlikely to be successfully managed by laparoscopic techniques. Other authors have also reported a high conversion rate in patients with SBO suspected to be secondary to malignancy.[16]

Long-term follow-up to evaluate the impact of laparoscopy on the recurrence of adhesions that lead to bowel obstruction is also very important. Several animal models have shown a reduction in both the rate and severity of adhesions formation when laparoscopy is performed compared to conventional laparotomy.[24] Other authors have also demonstrated that fewer adhesions form after laparoscopic procedures than after conventional laparotomy.[15,25,31] In the long term, this advantage may prove to be the most important in reducing morbidity and mortality related to obstruction secondary to adhesions.

Any surgeon with advanced laparoscopic skills, who has performed a standard midline incision to release a single adhesive band, regrets that the same operation could have been performed laparoscopically. A single band is so easily managed by laparoscopic techniques with only three 5 mm puncture wounds. The additional trauma of a standard exploratory laparotomy is difficult to justify. In comparison, the 20 cm (or larger) midline incision is associated with more postoperative pain, longer hospital stay, greater morbidity, more wound complications (infection, incisional hernia, etc.), longer operative times and, possibly, more adhesion formation.[4–20] It is for this reason that we are so enthusiastic about this approach. And why we believe laparoscopy should not only be included, but be the first step in the algorithm for SBO treatment.

CONCLUSION

We believe all patients determined to be operative candidates in the setting of acute small bowel obstruction should undergo laparoscopy initially. A systematic approach results in a high success rate and efficient operation. By specifically identifying those patients with a single band as the cause of obstruction, a significant number of patients will be spared a large laparotomy incision. Therefore, patients will benefit from shorter operative times, less adhesion formation, fewer wound complications (infection/hernia), quicker recovery, shorter hospital stay, and less pain.[1–30] Conversion should not be viewed as failure, but rather, a sometimes necessary step in the optimal management of these patients. We add our own experience with 61 patients to the growing number of cases reported in the literature.

References:

1. Adams S, Wilson T, Brown AR. Laparoscopic management of acute small bowel obstruction. *Aust N Z J Surg.* 1993;63(1):39–41.

2. Franklin ME Jr., Dorman JP, Pharand D. Laparoscopic surgery in acute small bowel obstruction. *Surg Laparosc Endosc.* 1994;4(4):289–96.

3. Strickland P, Lourie DJ, Suddleson EA, Blitz JB, Stain SC. Is laparoscopy safe and effective for treatment of acute small-bowel obstruction? *Surg Endosc.* 1999;13(7):695–698.

4. Agresta F, Piazza A, Michelet I, Bedin N, Sartori CA. Small bowel obstruction. Laparoscopic approach. *Surg Endosc.* 2000; 14(2):154–156.

5. Al-Mulhim AA. Laparoscopic management of acute small bowel obstruction. Experience from a Saudi teaching hospital. *Surg Endosc.* 2000;14(2):157–160.

6. Bailey IS, Rhodes M, O'Rourke N, Nathanson L, Fielding G. Laparoscopic management of acute small bowel obstruction. *Br J Surg.* 1998;85(1):84–87.

7. Bastug DF, Trammell SW, Boland JP, Mantz EP, Tiley EH 3rd. Laparoscopic adhesiolysis for small bowel obstruction. *Surg Laparosc Endosc.* 1991;1(4):259–262.

8. Borzellino G, Tasselli S, Zerman G, Pedrazzani C, Manzoni G. Laparoscopic approach to postoperative adhesive obstruction. *Surg Endosc.* 2004;18(4):686–690.

9. Cavaliere D, Schirru A, Caristo I, Bianchi M, Cosce U, Cavaliere P. Laparoscopic management of small-bowel obstruction [in Italian]. *Chir Ital.* 2005;57(2):215–220.

10. Chopra R, McVay C, Phillips E, Khalili TM. Laparoscopic lysis of adhesions. *Am Surg.* 2003;69(11):966–968.

11. Chosidow D, Johanet H, Montariol T, et al. Laparoscopy for acute small-bowel obstruction secondary to adhesions. *J Laparoendosc Adv Surg Tech A.* 2000;10(3):155–159.

12. Dallemagne B. Small bowel obstruction and adhesiolysis. In: Cueto-Garcia J, Jacobs M, Gagner M, eds. *Laparoscopic Surgery.* New York, NY: McGraw-Hill; 2003;301–303.

13. Fischer CP, Doherty D. Laparoscopic approach to small bowel obstruction. *Semin Laparosc Surg.* 2002;9(1):40–45.

14. Franklin ME Jr., Gonzalez JJ Jr., Miter DB, Glass JL, Paulson D. Laparoscopic diagnosis and treatment of intestinal obstruction. *Surg Endosc.* 2004;18(1):26–30.

15. Garrard CL, Clements RH, Nanney L, Davidson JM, Richards WO. Adhesion formation is reduced after laparoscopic surgery. *Surg Endosc.* 1999;13(1):10–13.

16. Ibrahim IM, Wolodiger F, Sussman B, Kahn M, Silvestri F, Sabar A. Laparoscopic management of acute small-bowel obstruction. *Surg Endosc.* 1996;10(10):1012–1015.

17. Keating J, Hill A, Schroeder D, Whittle D. Laparoscopy in the diagnosis and treatment of acute small bowel obstruction. *J Laparoendosc Surg.* 1992;2(5):239–244.

18. Kirshtein B, Roy-Shapira A, Lantsberg L, Avinoach E, Mizrahi S. Laparoscopic management of acute small bowel obstruction. *Surg Endosc.* 2005;19(4):464–467.

19. Leon EL, Metzger A, Tsiotos GG, Schlinkert RT, Sarr MG. Laparoscopic management of small bowel obstruction: indications and outcome. *J Gastrointest Surg.* 1998;2(2):132–140.

20. Levard H, Boudet MJ, Msika S, et al. Laparoscopic treatment of acute small bowel obstruction: a multicentre retrospective study. *ANZ J Surg.* 2001;71(11):641–646.

21. Liauw JJ, Cheah WK. Laparoscopic management of acute small bowel obstruction. *Asian J Surg.* 2005;28(3):185–188.

22. Nagle A, Ujiki M, Denham W, Murayama K. Laparoscopic adhesiolysis for small bowel obstruction. *Am J Surg.* 2004;187(4): 464–470.

23. Navez B, Arimont JM, Guiot P. Laparoscopic approach in acute small bowel obstruction. A review of 68 patients. *Hepatogastroenterology.* 199;45(24):2146–2150.

24. Reissman P, Spira RM. Laparoscopy for adhesions. *Semin Laparosc Surg.* 2003;10(4):185–190.

25. Rosin D, Kuriansky J, Bar Zakai B, Shabtai M, Ayalon A. Laparoscopic approach to small-bowel obstruction. *J Laparoendosc Adv Surg Tech A.* 2000;10(5):253–257.

26. Sato Y, Ido K, Kumagai M, et al. Laparoscopic adhesiolysis for recurrent small bowel obstruction: long-term follow-up. *Gastrointest Endosc.* 2001;54(4):476–479.

27. Suter M, Zermatten P, Halkic N, Martinet O, Bettschart V. Laparoscopic management of mechanical small bowel obstruction: are there predictors of success or failure? *Surg Endosc.* 2000;14(5):478–483.

28. Tsumura H, Ichikawa T, Murakami Y, Sueda T. Laparoscopic adhesiolysis for recurrent postoperative small bowel obstruction. *Hepatogastroenterology.* 2004;51(58):1058–1061.

29. Wu JM, Lin HF, Chen KH, Tseng LM, Huang SH. Laparoscopic diagnosis and treatment of acute small bowel obstruction resulting from a congenital band. *Surg Laparosc Endosc Percutan Tech.* 2005;15(5):294–296.

30. Wullstein C, Gross E. Laparoscopic compared with conventional treatment of acute adhesive small bowel obstruction. *Br J Surg.* 2003;90(9):1147–1151.

31. Duepree HJ, Senagore AJ, Delaney CP, Fazio VW. Does means of access affect the incidence of small bowel obstruction and ventral hernia after bowel resection? Laparoscopy versus laparotomy. *J Am Coll Surg.* 2003;197(2):177–181.