Minimally Invasive Reoperation following Laparotomy

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ABSTRACT

The surgical indications for laparoscopic techniques continue to expand as experience is gained. This includes patients who have had a previous open abdominal operation and require surgical intervention. In addition to the generally accepted indications for laparoscopy, conditions such as reversal of colostomy, small bowel obstruction, and early reoperation for surgical complications may be managed using minimally invasive techniques. Specific considerations in this group of patients include peritoneal access and establishing domain, lysis of adhesions, and situations that should prompt conversion.

KEYWORDS: Laparoscopy, prior laparotomy

Objectives: Upon completion of this article, the reader should be able to identify concerns specific to laparoscopic surgery in the patient who has previously undergone open abdominal operation and measures that can be taken to limit risk of injury and complication.

In the early days of laparoscopy, previous abdominal operation was a relative contraindication to attempting minimally invasive surgery because of concern for the presence of adhesions and risk of injury. At present, minimally invasive techniques are being routinely employed not only in patients who have undergone previous operation but also in such surgical diseases as adhesive small bowel obstruction, incisional hernia repair, and colostomy reversal. Despite the general acceptance that laparoscopy is applicable in these patients, there is very little literature specific to laparoscopy following laparotomy. Much of our knowledge regarding this entity must be extracted from the general laparoscopic literature. Specific concerns that should be considered in undertaking laparoscopy in patients who have undergone previous open abdominal surgery include the level of experience of the surgeon, individual patient-related factors such as type of and indication for previous operation, peritoneal access technique to be used, and findings and complications that favor conversion to an open procedure.

The level of experience necessary and the implications this experience has for the success rates and outcomes of laparoscopic procedures are unknown. Most of the reports specific to surgeon experience pertain to obesity surgery and urologic procedures.^{1,2} Although, generally, conversion and complication rates and operative times decrease with increasing experience, transferring this information for practical application is extremely difficult. Given the variations in individual surgeons' abilities and the types of laparoscopic procedures and skill sets needed for each, the experience needed to perform these procedures has not and may not be quantified. The decision concerning which patients are treated with laparoscopic techniques and factors favoring conversion are left to the individual surgeon's judgment.

Patient-related factors can be more objectively described but also have a variable impact on the ability to perform reoperative laparoscopic surgery. These factors include the type and number of previous abdominal operations, including the location of the incision, and

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the indication for the previous procedure such as obstetrical, peritonitis, and upper or lower abdominal pathology. The likelihood and location of adhesions based on these factors are the primary concern. Brill et al examined some of these issues in 360 women undergoing laparoscopy after laparotomy.³ Their findings indicated that prior midline incisions, especially above the umbilicus, had the highest incidence of omental and bowel adhesions to the anterior abdominal wall. Patients with a history of obstetrical procedures through either midline or Pfannenstiel incisions had the lowest rate of bowel or omental adhesions. In this series, 5.8% of woman suffered an injury to the omentum or bowel during the procedure and most frequently repair was performed laparoscopically when necessary. Although it is well recognized both clinically and experimentally that peritoneal inflammation increases adhesion formation, the exact impact previous peritonitis has on the ability to perform laparoscopy is unknown, and laparoscopic surgery is technically feasible in many of these patients.^{4,5} A history of peritonitis increases the risk of intestinal adhesions beyond the location of the abdominal incision because of diffuse abdominal inflammation and must be considered when approaching a patient laparoscopically.

Once the decision is made to attempt a laparoscopic procedure in a patient with a previous abdominal surgery, the method of peritoneal access must be chosen. Approximately 40% of bowel injuries that occur during laparoscopy occur during establishment of pneumoperitoneum.⁶ Although infrequent, access injuries from trocars and Veress needles occur, and these are the most common devices named in malpractice claims in the United States. In a review of events reported to the Food and Drug Administration, fatal and nonfatal injuries occurred with all types of access devices but most commonly with shielded and optical trocars.⁷ In a review of 14,243 Swiss patients undergoing laparoscopy, there was an incidence of 0.182% access injuries, 60% occurring in patients who had previous surgical procedures.⁸ Regardless of access technique, the potential for injury exists as described by Corson et al in a review of litigated cases in Canada and the United States.⁹ In this review, there were 185 access injuries related to various trocars in 246 litigated cases, 16 from blunt trocars. There were 39 nontrocar injuries with the use of needle techniques. Given these reports, access in laparoscopy is a potential source of significant morbidity and there is no failsafe device or method.

Clearly, safe establishment of pneumoperitoneum is critical. There are many techniques described including the open Hasson and Veress needle insertion with both umbilical and alternative sites to the umbilicus such as left subcostal. Optical trocars with visualization for direct trocar insertion have been utilized as well with mixed results. For all patients undergoing laparoscopic

surgery, there has been no definitive study demonstrating superiority of one technique over the other for reducing insertion injuries. Given the overall incidence of trocar-related injuries of 0.18%, the size of the series necessary to demonstrate confidently a difference between techniques, especially in patients who have undergone previous abdominal surgery, is very large, and such a study has not been performed to date. There have been several comparatively smaller series of access techniques in patients with a history of previous surgery, and, although small, they serve to demonstrate that safe access can be achieved in patients who have had a prior abdominal operation. Agarwala et al reviewed 918 patients who had undergone previous operation.¹⁰ After left upper quadrant insertion, 54.9% of patients were seen to have umbilical adhesions that would have prevented or limited direct umbilical access. All procedures were completed laparoscopically with a 0.39% Veress needle injury rate. The prospective series by Rafii et al comparing Veress needle access in patients without previous surgery through the umbilicus and patients with previous surgery through the left upper quadrant had similar findings.¹¹ The open Hasson technique has been used in alternative sites such as the left upper quadrant as well with success.¹² Although no technique has been clearly demonstrated superior, avoidance of access attempts through previous scars, willingness and ability to change the type of access if initial attempts fail, and close inspection of the area when pneumoperitoneum is established are basic tenets.

Obviously, obtaining access in a site remote from adhesions is ideal. Unfortunately, there are few techniques available to the surgeon to identify the location of adhesions except for previous incision location. Several authors have reported the novel use of ultrasonography to identify "visceral slide" of bowel loops during respiration and the "peritoneal reflection band sign," which relies on the presence of tethering bands to the abdominal wall.¹³⁻¹⁵ Although the accuracy and sensitivity have been reported to be as high as 100%, this is clearly a specialized technique that is extremely operator dependent. In centers with this level of experience with ultrasonography, it may serve as an aid in safe establishment of pneumoperitoneum.

When pneumoperitoneum is established, much of the challenge of laparoscopic surgery in the previously operated patient may result from adhesions. As with most aspects of reoperative surgery in laparoscopy, there is little to guide the surgeon in the literature regarding this portion of the procedure. Although many injuries occur during access, nearly 60% occur later in the procedure and may be related to coagulation and arcing injuries, grasping, tearing with adhesiolysis, or scissor injuries as well as others. In cases requiring extensive lysis of adhesions, it is important to be alert to signs of bowel injury, both intraoperatively and postoperatively.

In a large meta-analysis of 430 intestinal injuries resulting from laparoscopy in 329,935 patients, 61% of intestinal injuries were diagnosed at the time of surgery, but nearly 40% of bowel injury recognition was delayed to the third postoperative day or longer.⁶ A significant delay in diagnosis of intestinal injury clearly increases morbidity and mortality and negates any potential benefits of laparoscopic surgery.

SPECIAL CIRCUMSTANCES

Small Bowel Obstruction

The ability to manage adhesive small bowel obstructions laparoscopically is theoretically appealing if the formation of future adhesions is less than with the open approach. The challenges specific to small bowel obstruction are significant and include obtaining safe access, establishing a domain especially when abdominal distention is present, and avoiding injury to the small intestine, which may be fluid filled and susceptible to tearing and injury. Since the first report in 1991 by Bastug et al, multiple nonrandomized studies have reported on the feasibility of treating adhesive small bowel obstruction laparoscopically with variable success rates of 6 to 65% and bowel injury rates of 3 to 17%.^{16–18} Wullstein and Gross reported on one of the only comparative trials between laparoscopic and open procedures, although it was a retrospective matched series.¹⁹ Conversions were included in the laparoscopic arm and the overall conversion rate was 51.9%. Successful laparoscopic surgeries had longer operative times (103 minutes) than open procedures (83 minutes), but converted procedures (84 minutes) were equal in duration to open procedures. Comparing completed laparoscopic operations with conventional surgery, there was no significant difference in bowel injury (10 and 7, respectively) and there were no bowel perforations with trocar insertion. Overall, there were 15 bowel injuries in the laparoscopic group, but 5 of the injuries occurred after conversion during the open portion of the procedure. The recovery of bowel function, length of hospital stay, and postoperative complications were shorter and fewer in the successful laparoscopic procedures.

Appropriate selection of patients may improve success rates and decrease complication rates. Generally, patients with peritonitis, a high suspicion for gangrenous bowel, or free air are likely to be best managed with conventional surgery. The need for an emergent operation may also increase the risk for conversion as this may not allow bowel decompression. Other factors that may increase the likelihood of conversion included significant small bowel dilation on radiologic testing (> 4 cm), history of severe adhesions, and, in some studies, increasing number of previous surgeries.^{17,20}

The choice of peritoneal access is via a Veress needle or the direct Hasson technique, avoiding areas of previous scar. As with laparoscopic access overall, there are no definitive data concerning the safety of one versus the other. Most authors recommend an open approach, although Sato et al reported on 16 patients undergoing Veress placement without complication.²¹

If peritoneal access and domain are achieved, the technique of adhesiolysis is based on generally adhered to guidelines. These include the use of atraumatic graspers, the avoidance of electrocautery, and a heightened awareness of potential bowel injury. Initial adhesiolysis with the camera may be performed in the presence of filmy adhesions to allow placement of additional trocars. The intraoperative findings of gangrenous bowel and matted bowel loops should prompt consideration of conversion to open surgery.

Overall, with careful technique, selection of patients, and a low threshold for conversion to open surgery, many patients with adhesive small bowel obstruction may be managed laparoscopically.

Hartmann's Reversal

As reported by Rosen et al, laparoscopy-assisted reversal of left-sided colostomies is feasible and, in their series, safe.⁵ In this report, 22 patients underwent attempted laparoscopic reversal. Initial access was either through a cutdown in the left upper quadrant or through the colostomy site after takedown of the stoma. There were two conversions because of adhesions to the rectal stump. In no case, despite multiple patients with a history of peritonitis, was there failure to establish a pneumoperitoneum or inability to lyse adhesions outside the rectal stump. The overall wound infection rate was 14% in three patients, all superficial and limited to the colostomy site, and there were no anastomotic leaks. Advantages of the laparoscopic approach in these patients include ability to perform splenic flexure mobilization without extension of the abdominal incision, limited size of incision with decreased severity and size of wound infection, and potentially decreased pain.

Laparoscopy Immediately following Laparotomy

There are many postoperative conditions that may warrant early postoperative reexploration. These include hemorrhage, intra-abdominal abscess, small bowel obstruction, bile leak, ischemic bowel disease, retrieval of retained foreign bodies, and anastomotic leakage. Most surgeons are hesitant to reoperate on a patient who had a recent laparotomy without definite confirmation of an intra-abdominal complication. This may be even more the case in the critically ill patient in the intensive care unit. Much of this hesitancy results from the knowledge

that early postoperative laparotomy is associated with significant morbidity and potentially impaired wound healing.²² A negative laparotomy given a potential worsening of the outcome should clearly be avoided. In an experimental rat model, bursting and tensile strengths were compared between rats undergoing early postoperative laparotomy or laparoscopy. For rats undergoing laparotomy, both parameters were decreased, indicating potentially impaired wound healing, but they were unaffected in those undergoing laparoscopy.²³

The laparoscopic approach has been found safe in a small series of 14 patients who underwent postoperative laparoscopy from 3 to 15 days following laparotomy.²⁴ The procedure was technically possible in 13 patients, there was one missed retroperitoneal collection following a pancreatectomy, and there was one early death from sepsis after drainage of an abscess. Otherwise, all patients recovered without complication or need for further intervention. The ability to perform laparoscopy early in the postoperative period with a decrease in the risk of altered wound healing and increased complications might potentially lead to a decrease in the delay in diagnosing significant intra-abdominal complications. This might lessen the morbidity overall related to these complications. This included patients in the intensive care unit as well, who may be able to undergo bedside diagnostic laparoscopy and avoid transportation to the operating room unless necessary.

SUMMARY

As surgeons become more comfortable with the techniques of laparoscopic surgery, patients with increasingly complex surgical issues will undergo these procedures. There is a paucity of randomized prospective trials comparing laparoscopy with conventional surgery as a whole, let alone in the postlaparotomy patient. These studies are likely never to be performed as it becomes more accepted that laparoscopic surgery in experienced hands is safe and merely a different route by which to care for surgical diseases. The information that is available clearly demonstrates that laparoscopy is a viable approach in patients who have had previous abdominal surgery. The theoretical and proven advantages of less pain, fewer adhesions, and wound complications are likely to be true in these cases as well. The major pitfalls of obtaining access and domain are real concerns but can be managed safely in the majority of patients. Surgeons' experience and judgment are presently not well measured or quantified but cannot be discounted as a means of decreasing serious complications.

DISCLOSURE

The author has no conflicts to disclose relative to this article.

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