

Laparoscopic Repair of Incisional and Other Complex Abdominal Wall Hernias

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Abstract

Incisional hernia is one of the most common complications of abdominal surgery, with a reported occurrence rate of up to 20% after laparotomy. The high incidence of hernia formation significantly contributes to both patient morbidity and health care costs. Although a variety of approaches have been described to repair these defects, historically the results have been disappointing. Recurrence rates after primary repair have been reported to range from 24% to 54%. The recent advent of laparoscopic ventral hernia repair (LVHR) has offered promising outcomes by combining tension-free repair using a prosthesis with minimally invasive techniques, lowering reported recurrence rates to <10%. This review discusses standardized, well-researched techniques that have contributed to the success of LVHR. We also discuss how these techniques have been modified for laparoscopic repair of suprapubic lumbar hernias, hernias near the iliac crest, and parastomal hernias. In addition, we review our own experience with LVHR in the context of the principles discussed.

Incisional hernia is one of the most common complications of abdominal surgery, with a reported occurrence rate of up to 20% after laparotomy.¹ The high incidence of hernia formation significantly contributes to both patient morbidity and health care costs.² Although a variety of approaches have been described to repair these defects, the results have been historically disappointing. Recurrence rates after primary repair have been reported to range from 24% to 54%.^{1,3-5} Risk factors for recurrence include suture repair, infection, prostatism, and previous surgery for an abdominal aortic aneurysm.³ The incorporation of prosthetic mesh improved the durability of the repair regardless of the size of the hernia but surgery still resulted in recurrence rates of up to 34%.^{3,5,6} Repair of a recurrent incisional hernia has been associated with recurrence rates of

up to 48%.⁷ The recent advent of laparoscopic ventral hernia repair (LVHR) has offered promising outcomes by combining tension-free repair using a prosthesis with minimally invasive techniques, lowering reported recurrence rates to <10%.⁸⁻¹¹

Pooled analysis of LVHR compared with open ventral hernia repair (OVHR) encompassing 5340 patients in a 14-year period revealed that LVHR was associated with significantly fewer wound complications (3.8% vs 16.8%; $p < 0.0001$), fewer total complications (22.7% vs 41.7%; $p < 0.0001$), fewer hernia recurrences (4.3% vs 12.1%; $p < 0.0001$), and a shorter length of stay (2.4 vs 4.3 days; $p = 0.0004$). No differences in cardiac, neurologic, septic, genitourinary, or thromboembolic complications were found. The mortality rate was 0.13% for LVHR and 0.26% for OVHR ($p = NS$).¹²

Incisional Hernias

Current approaches for LVHR are based on the open, preperitoneal technique described by Stoppa¹³ and Rives et al.¹⁴ Placement of a large prosthesis in the preperitoneal space allows for intraabdominal force to be dispersed over a greater surface area, which may contribute to the strength and durability of the repair.¹⁵ Although the incorporation of mesh has greatly reduced the number of recurrences after repair of incisional hernias,³ the results are technique dependent. Essential to the success of the laparoscopic approach is adequate mesh fixation. Current approaches to LVHR in North America involve fixation of the mesh with permanent transabdominal sutures and tacks.⁹ Bageacu et al¹⁶ reported a recurrence rate, confirmed by computed tomography, of 15.7% during a mean follow-up period of 49 months in their series of 121 patients who underwent LVHR. The authors attributed the relatively higher recurrence rate in their study subjects to inadequate mesh fixation because of lack of transabdominal sutures and use of tacks alone. Experimental studies have also demonstrated the superiority of transabdominal sutures compared with tacks for mesh fixation. Both absorbable

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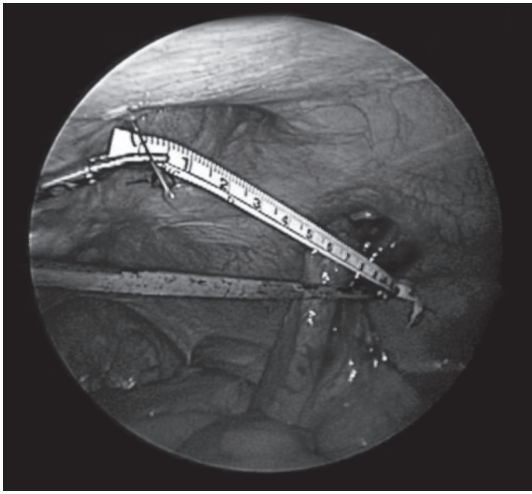


Figure 1. Defect measured intercorporeally using spinal needles to accurately define the borders of the hernia.

and permanent sutures had greater fixation strength than metallic tacks, although absorbable sutures had a significant loss of strength compared with permanent sutures at eight weeks.¹⁵ Subsequent clinical series have shown early recurrences when metallic tacks alone were used for fixation, leading to advocacy of additional transabdominal sutures for repair.¹⁷⁻¹⁹

In our experience, adequate mesh coverage is also essential for a durable hernia repair. For our laparoscopic repairs, we begin by establishing a pneumoperitoneum of 15 mmHg using a Veress needle in the left upper quadrant. The abdomen is entered under direct visualization with the Optiview bladeless trocar (Ethicon Endo-Surgery, Somerville, NJ, USA). A minimum of two additional 5-mm trocars are introduced in the left flank. A complete adhesiolysis of the abdominal wall, possibly the most difficult part of the procedure, is performed. Rudmik et al²⁰ calculated an overall risk of enterotomy of 2.1%. Once adhesiolysis has been completed, full visualization of the abdominal wall provides an additional technical advantage of LVHR over OVHR, with small fascial defects ("Swiss cheese") being fully visible and covered with the prosthesis. We plan a 4- to 5-cm overlap of mesh beyond all areas of fascial defect. To ensure accurate mesh sizing, we measure the fascial defect size internally with a metric ruler. The fascial edges are marked with spinal needles and the true defect size is determined (Figure 1). This avoids overestimating the size of the defect and subsequently the size of the needed mesh, which can happen when the defect is measured externally because of differences in patient abdominal wall thickness and contour.

With proper technique, the outcomes of LVHR have

been shown to be excellent, with a low recurrence rate. Heniford et al⁹ reported their experience with 850 consecutive LVHRs using the standardized techniques just described. After a mean follow-up period of 20.2 months, the hernia recurrence rate was 4.7%. Their series also demonstrated a moderate complication rate (13.2%) and an average hospital stay of 2.3 days. One of the theoretic disadvantages of LVHR is that the hernia sac is left in place, leading to a greater incidence of seroma formation. In the series of Heniford and colleagues, only 2.6% of patients experienced seromas that persisted for more than eight weeks or caused symptoms requiring aspiration. Infection does not generally occur in these collections, regardless of whether they are aspirated immediately or are allowed to persist beyond eight weeks.²¹ Series have demonstrated comparable postoperative pain for LVHR and OVHR,²¹ although pain lasting beyond 12 weeks at the site of a transabdominal suture has a reported occurrence rate of 1.3% to 3.3%.^{8,15,22} This generally responds to anti-inflammatories or injection of local anesthetic at the suture site. On rare occasions, it is necessary to remove the anchoring suture to relieve the pain.

Our practice has extended these outcomes to include a significantly older population. In our review of 97 patients with a mean age of 68.5 years who underwent LVHR within a four-year period, the recurrence rate was reported as 2%, with low morbidity.²³ We have also reviewed our experience with LVHR in patients who have undergone organ transplantation and are receiving maintenance immunosuppression. When they were compared with a cohort of patients who had not undergone transplantation, the recurrence rates were similar (7.9% and 2.9%, respectively; $p = 0.1330$) with no increase in morbidity.²⁴

Suprapubic Lumbar Hernias and Hernias Near the Iliac Crest

Historically, periosteal suture fixation has been used to secure the mesh during suprapubic hernia repairs. However, studies have shown that lack of secure fixation of mesh in the suprapubic position has led to an increased rate of recurrence in LVHR.²⁵ The lack of fascia in this location has generated a need for an alternative method for secure fixation. Bone anchors have been safely used in orthopedic surgery for many years, and the pull-out strength of suture bone anchors is superior to that of simple periosteal suture fixation.^{26,27} Suture bone anchors allow a firmer attachment of the mesh to stronger bony or ligamentous structures, as opposed to muscle at the hernia's border. A previous study

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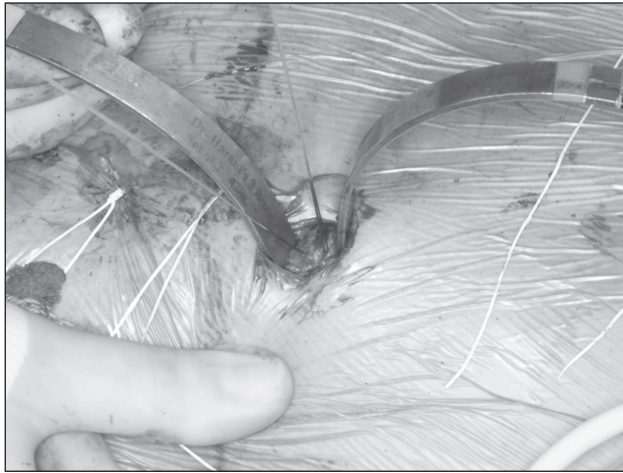


Figure 2. Dissection and placement of bone anchor sutures at the anterior superior iliac spine.

described ten patients with lumbar hernias repaired in an open fashion with bone anchor fixation to the iliac crest, resulting in no recurrences during a 40-month follow-up period.²⁸ Those results prompted the use of bone anchors for suprapubic hernias as well, because recurrences tend to be at the inferior location over the pubic bone.²⁹ Our practice for suprapubic hernias is placement of a three-way Foley catheter to allow saline to be instilled into the bladder to aid in its identification during dissection. The entire preperitoneal space is dissected to identify the pubis, the Cooper ligament bilaterally, and the inferior epigastric vessels. This allows for placement of the mesh with good overlap and avoidance of neurovascular injuries. The mesh can then be secured to the Cooper ligament with tacks and secured with additional bone anchors placed in the pubis. The same type of anchors can be applied for hernias near the anterior iliac spine (Figure 2). In our series of 30 patients who underwent LVHR with at least one bone anchor, the recurrence rate was 6.7% after a mean follow-up period of 13.2 months (range, 1–26 months). The complication rate was moderate (7 patients; 23.3%), with a mean length of stay of 5.2 days³⁰ (Figures 3 and 4).

Parastomal Hernias

Parastomal hernias present a particularly challenging problem because the stoma itself must remain a defect despite repairing the hernia. Traditional surgical management has consisted of local tissue repair, stoma relocation, or placement of a prosthetic mesh.^{31–34} Hernia recurrence rates for primary fascial closure are reported to range from 46% to 100%.^{34–36} Stoma relocation is reported to have a hernia recurrence rate of 36%

(range, 0%–76%)^{34,35,37,38} but may require an additional laparotomy. Open repair with polypropylene mesh has improved these outcomes, but it is still associated with a failure rate of 26% to 29%. Overall complication rates of up to 88%,³³ combined with a growing number of reports of decreased patient morbidity and improved outcomes with laparoscopic tension-free mesh repair of ventral hernias, have led many surgeons to apply these techniques to this difficult problem. Laparoscopic repair has offered an alternative approach, and small series have reported encouraging results. Two main techniques have been employed: keyhole and Sugarbaker.

Paul H Sugarbaker³⁹ was the first to describe the placement of intraperitoneal mesh for the repair of parastomal hernias. His technique involved placing a piece of mesh around the fascial defect and securing it circumferentially, except laterally where the colon exited the abdominal cavity to create a mesh flap valve around the stoma to help prevent further herniation.



Figure 3. Hernia defect near the anterior superior iliac spine, before repair surgery.

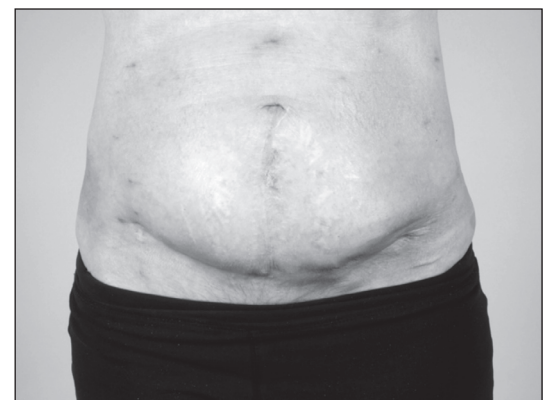


Figure 4. Hernia laparoscopically repaired with ePTFE (expanded polytetrafluoroethylene) mesh and bone anchor sutures.

He advocated laparotomy for placement of the mesh to avoid contact with the stoma bud and thus reduce infection. In his series of six patients, there were no recurrences or mesh-related complications after four to seven years of follow-up monitoring. In contrast, with the keyhole technique, a 2- to 3-cm keyhole defect is created in the mesh to accommodate the ostomy without the creation of a flap valve as described by Sugarbaker. Additional interrupted sutures are placed intra- or extracorporeally along the linear defect in the mesh leading away from the ostomy. We have employed both the Sugarbaker and keyhole techniques in our laparoscopic approach to parastomal hernia repairs. Early in our own experience, we performed the keyhole technique, but we currently prefer the Sugarbaker approach. In our experience as well as that of others, the Sugarbaker technique has been found to be technically less demanding, associated with decreased surgery duration, and decreased recurrence rates.⁴⁰

Although the laparoscopic approach to the repair of parastomal hernias is relatively novel, several series have been reported that had promising short-term results. Mancini et al⁴¹ reported results from their multicenter trial involving 25 patients who underwent laparoscopic Sugarbaker repair with ePTFE (expanded polytetrafluoroethylene). The overall postoperative morbidity was 23%, and the mean hospital length of stay was 3.3 days. During a median follow-up period of 19 months (range, 2–38 months), 4% (1 of 25) of the patients experienced recurrence. We have recently reported our own series of 21 laparoscopic parastomal hernia repairs (9 urostomies, 7 ileostomies, and 5 colostomies).⁴² The mean defect size was 130 cm² (range, 25–416 cm²), and the mean mesh size was 440 cm² (range, 240–780 cm²). All repairs were successfully completed laparoscopically. Mean duration of surgery was 210 minutes (range, 99–326 minutes). Two patients required mesh removal because of infection. The duration of follow-up monitoring ranged from 1 to 17 months (mean, 6 months). There have been no recurrences.

Laparoscopic parastomal hernia repair seems to offer a good alternative to open repair, with acceptable complication rate and low recurrence in the short term.

Summary

Ventral hernia is one of most common complications after abdominal surgery. Historically high recurrence rates have led to an evolution of techniques from open primary repair, to incorporation of a prosthesis, and most recently to laparoscopic mesh placement. The application of minimally invasive techniques has

reportedly led to a more durable repair. LVHR appears to offer superior outcomes in the short term, primarily because of the ability it gives surgeons to provide superior overlap of mesh and the incorporation of transabdominal sutures for fixation. As this approach becomes more widely applied to increasingly complex hernias, the surgeon will have to be aware of techniques that allow for adequate mesh coverage and fixation to ensure optimal outcomes. ❖

Disclosure Statement

The author(s) have no conflicts of interest to disclose.

Acknowledgment

Katharine O'Moore-Klopf, ELS, of KOK Edit provided editorial assistance.

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The Least Troublesome Cure

The prime object of the physician in the whole art of medicine should be to cure that which is diseased; and if this can be accomplished in various ways, the least troublesome should be selected; for this is more becoming a good man, and one well skilled in the art, who does not covet popular coin of base alloy.

— On the Articulations, *Hippocrates, c 460 BC – c 370 BC, ancient Greek physician in the Age of Pericles*