



# Hybrid fascial closure with laparoscopic mesh placement for ventral hernias: a single surgeon experience

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**Background:** Incisional hernia and primary ventral hernia are among the most common surgical problems that general surgeons face annually in the United States (U.S.). Over 2 million laparotomies are performed in the US and the subsequent incisional hernia rate is 3–20%. At our institution, over the last several years, one surgeon has been performing a unique repair of intermediate-sized hernias by combining open and laparoscopic approaches. We hypothesized that, through a minimal incision, lysis of adhesions and primary repair can be performed, which can then be buttressed with a laparoscopically placed mesh that provides a generous underlay reinforcement that cannot be achieved in open repair. Furthermore, this technique provides the additional benefit of apposition of the rectus muscles and decreased seroma formation compared to laparoscopic hernia repair.

**Methods:** Patients that underwent ventral hernia repair with laparoscopic assistance at NYU Lutheran Medical Center between October of 2012 and January 2015 form this study population. Each patient's demographic, intra-operative, and postoperative data were collected and analyzed. Patient demographics included gender, age, BMI, prior abdominal surgery, co morbidities, and anticoagulation use. Intra-operative data included defect size, mesh size, and operative time. Postoperative data included complications, length of hospitalization, recurrences, seroma formation, surgical site infections (SSI), and mesh explantation. The surgical technique was as follows: a minimal incision was used over the defect which was only big enough to allow dissection down to the hernia borders. The hernia was reduced and lysis of adhesions of surrounding tissue performed. The hernia was sized and a mesh chosen to provide at least 3 to 5 cm of underlay around the defect. A series of one to four stay sutures were placed in the midline of the mesh and the mesh was placed intra-corporeally. The defect was closed primarily using the Smead-Jones technique (in 17 of 19 patients) to provide a tension-free double layer closure. The abdomen was insufflated, the mesh visualized, fixed to the midline via the stay sutures, and tacked circumferentially. The subcutaneous tissue and the skin were closed with absorbable suture.

**Results:** A total of 19 patients (12 females, 7 males) underwent the hybrid hernia repair from October 2012 through January 2015. Only 1 (5%) was admitted postoperatively due to severe underlying co morbidities. The average size of the hernia defect was 5.94 cm<sup>2</sup> (2.5–15 cm<sup>2</sup>) with an average mesh size of 16×16 cm<sup>2</sup> (9×9–25×20 cm<sup>2</sup>) being used. Average operative time was 153 minutes with a range of 69–281 minutes. One (5%) had an early (within the first three months post-surgery) recurrence of the hernia. One patient (5%) had an early superficial SSI noticed during the 1 week follow-up appointment and was treated with oral antibiotics. None of the patients required re-hospitalization. None of the patients developed any seroma or any deep tissue infections requiring mesh explantation. Fourteen (74%) of the 19 patients were reached via telephone for further follow-up. All 14 patients were satisfied with the results of their surgery with only 1 complaint of pre-existing gastritis unrelated to the surgery. All of the patients that were employed prior to the surgery were able to return to work post-operatively. None of the patients reported any residual incisional or back pain.

**Conclusions:** Hybrid ventral hernia repair has the physiological benefit of fascial continuity by re-

approximating the hernia edges. This technique also maximizes the benefit of laparoscopic repair while minimizing associated complications. Patients had no severe wound complications. This surgical technique resulted in a low recurrence rate, and minimal pain after the procedure, making the hybrid technique a safe alternative method when repairing intermediate sized ventral hernias.

**Keywords:** Ventral hernia mesh repair; bridged mesh repair; primary fascial closure with mesh underlay; laparoscopic ventral hernia repair

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## Introduction

Ventral hernia, be it an incisional hernia or a primary ventral hernia, is one of the most common surgical challenges that general surgeons face annually in the U.S. Over 2 million laparotomies are performed in the U.S. and the subsequent incisional hernia rate is 3–20% (1). Herniation leads to a range of problems for patients, from functional and cosmetic problems to life threatening incarceration and strangulation of the hernia contents. Many different surgical techniques have been proposed to repair the hernia defect, from primary repair to open repair with mesh, to laparoscopic, which has been popularized since the 1990s, to the more recent robotic repair (2,3). Primary repair, however, has unacceptably high recurrence and wound complication rates compared to the laparoscopic approach (3,4). In a large multivariate meta-analysis looking at open suture hernia repair versus open mesh hernia repair, it was shown that recurrences were more common with suture repair (8.2% versus 2.7%) whereas seromas (7.7% versus 3.8%) and SSI (7.3% versus 6.6%) were higher in the mesh repair group (5). Although laparoscopic repair has gained popularity and has proven advantageous with respect to recurrence, wound complication, and hospital stay, seroma formation is one of most common problems that occurs (6). This is due to the fact that the defect is not re-approximated and the hernia sac is not excised during the laparoscopic repair. Yet another issue that occurs with the laparoscopic approach is chronic pain at the trans-myofascial suture sites (7).

A critical factor that should not be overlooked in the analysis of ventral hernia repair outcomes is the physiological consequences that a large defect has on the patient. The physiology of the abdominal muscles is well studied and reported. The abdominal muscles play a significant role in performing daily functions, including respiration, trunk movements, speech, back support, and

compression of the abdominal contents during expulsive activities such as coughing, defecation, and vomiting (8-10). Ramirez and Toranto reported resolution of back pain after repairing abdominal wall defects, or abdominoplasty (11,12). Extensive literature has demonstrated the importance of maintaining intact abdominal muscle to perform routine functions. Orenstein has specifically looked at the benefit of closure of the defect and how it returned the functional and dynamic abdominal wall to its physiologic state (13). Another common problem that is widely reported in the literature is abdominal “bulging” that occurs after hernia repair that does not re-approximate the abdominal wall muscles causing patient dissatisfaction and hindrance (14,15). For these reasons, we propose that when performing a ventral hernia repair, it is crucial to re-approximate the abdominal wall muscle.

At our institution, one surgeon has been performing a unique repair of intermediate-sized hernias by combining open and laparoscopic approach over the last several years.

We hypothesize that by minimizing the size of the incision but introducing larger mesh that would not be otherwise possible via laparoscopy, we can achieve the benefits of primary closure with large mesh underlay while decreasing seroma formation and maintaining low rates of recurrence and wound complication.

## Methods

A total of 19 patients underwent laparoscopically-assisted hernia repair with primary closure mesh underlay at NYU Lutheran Medical Center between October of 2012 and January 2015 and form the basis of this study. Each patient's demographic, intra-operative, and postoperative data was collected and analyzed. Patient demographics included gender, age, BMI, prior abdominal surgeries, co morbidities, and anticoagulation use. Intra-operative data included defect size,

mesh size, and operative time. Postoperative data included complications, length of hospitalization, recurrences, seroma formation, and surgical site infections (SSI).

### *Surgical technique*

The surgery was performed by a single MIS fellowship-trained surgeon with over 8 years of clinical experience. Surgery was performed under general endotracheal anesthesia. Each patient was placed in the supine position on the operating table, and arms were tucked. The abdomen was prepped with chlorhexidine gluconate (2% CHG). A limited incision was made over the hernia defect. In each case the incision was only large enough to allow dissection of the hernia sac, exposure of the fascial borders, and enough exposure to perform dissection of adhesions from the anterior abdominal wall and from the hernia site. Adhesiolysis at times completely freed the anterior abdominal wall and at other times only allowed for open port placement, intracorporeal placement of a rolled mesh, and primary closure of the fascia. In the latter cases, adhesiolysis was completed laparoscopically. Once the hernia was completely reduced and the defect size established, a dual polypropylene and collagen mesh was rolled and placed intracorporeally. One to four (depending on the size of the mesh) #1 prolene sutures were placed in the midline of the mesh. The mesh was curled, inserted into the intra-abdominal cavity, and left in place. A single 5 mm port was placed in the mid-lateral abdominal wall under direct palpation. The defect was closed primarily, using the Smead-Jones technique (in 17 of 19 patients) to provide a tension-free double layer closure. The abdomen was insufflated to 15 mmHg via the previously placed port and a 5 mm 30 degree camera was placed into the intra-abdominal cavity. One to three additional 5 mm ports were introduced depending on the size of the defect. The mesh was unrolled and the stay sutures brought up through the appropriate midline position using a suture passer. The mesh was pulled up against the anterior abdominal wall and the sutures tied down. Approximation of the mesh to the anterior abdominal wall was then achieved with circumferential absorbable tacks. Ports were then removed under direct visualization and the abdominal cavity desufflated. The wounds were irrigated, and skin edges were closed. All of the patients were successfully extubated and transferred to the PACU.

### **Results**

A total of 19 patients (12 females, 7 males) underwent the

**Table 1** Patient demographics

Variables	Number [%]
Total patients	19
Gender	
Female	12
Male	7
Age (years)	
Mean	46
Range	33–79
BMI (kg/m <sup>2</sup> )	
Mean	34.7
Range	28.8–45.4
Prior abdominal surgery	13 [68]
Comorbidities	
Tobacco use	8 [42]
HTN	8 [42]
DM	4 [21]
COPD	0
CAD	1 [5]
Anticoagulation use	0

hybrid hernia repair from October 2012 through January 2015. The average age of the patients was 46 (range: 33–79). Most of the patients were obese with a mean BMI of 34.7. Thirteen out of 19 (68%) of the patients had previous abdominal surgery. Co morbidities ranged from tobacco use to hypertension, diabetes, and coronary artery disease, with an average ASA score of 2.26. None of the patients were on oral anticoagulants at the time of the surgery (*Table 1*).

Out of 19 patients, only 1 (5%) was admitted post-operatively due to severe underlying co-morbidities unrelated to the surgery. The average size of the hernia defect was 5.94 cm<sup>2</sup> (2.5–15 cm<sup>2</sup>) with an average mesh size of 16×16 cm<sup>2</sup> (9×9–25×20 cm<sup>2</sup>) being used. Average operative time was 153 minutes with a range of 69–281 minutes. Of the 19 patients, 1 (5%) had an early (within the first three months post-surgery) recurrence of the hernia. One patient (5%) had an early superficial SSI noticed during the 1 week follow-up appointment. The SSI was successfully treated with oral antibiotics with full resolution by the next follow-up clinic appointment. None of the patients required

Table 2 Surgical outcome

Variables	Outcome
ASA score	2.26
Inpatient, n (%)	1 (5%)
Length of stay (days)	
Mean	1.1
Range	1–3
Size of defect (cm <sup>2</sup> )	
Mean	5.94
Range	2.5–15
Size of mesh (cm <sup>2</sup> )	
Mean	16×16
Range	9×9–25×20
Operative time (min)	
Mean	153
Range	69–281
Recurrences, n (%)	1 (5%)
Seromas, n (%)	0
Surgical site infections, n (%)	1 (5%)
Mesh explantation	0

re-hospitalization. None of the patients developed any seromas (Table 2).

All 19 patients were attempted to be reached via telephone for further follow-up, with successful contact in 14 (74%) patients. All 14 patients were satisfied with the results of their surgery with only 1 complaint of pre-existing gastritis unrelated to the surgery. All of the patients that were employed prior to the surgery were able to return to work post-operatively. None of the patients reported any residual incisional or back pain (Table 3).

## Discussion

There are many different options for surgeons to repair ventral hernias, including primary repair, mesh repair, laparoscopic repair, robotic repair, and free flap. There are advantages and disadvantages to all of the above (4). Although open mesh repair has shown an advantage over primary repair from the recurrence standpoint, it has significant wound complication and mesh explantation

Table 3 Patient satisfaction

Variables	Number [%]
Total patients reached	14 [74]
Patient follow-up	12 [86]
Pain (1–10 scale)	
Mean	1.14
Range	0–5
Satisfaction with procedure	13 [93]
Return to work	13 [93]

rates. Laparoscopic repair with underlying mesh placement has shown a benefit over open repair, with decreased length of hospital stay and wound complications, without increasing the recurrence rate. Our hybrid method of repairing the intermediate sized ventral hernia maximizes the physiological benefit of fascial continuity while reducing recurrence by using a generous, laparoscopically placed mesh. At the same time, the technique has reduced seroma formation while maintaining a low recurrence rate. We feel that the minimal extra-corporeal handling of the mesh results in the excellent results in terms of mesh infection. Furthermore, as evidenced by our low pain and high patient satisfaction scores, we hypothesize that our midline placement of the stay sutures not only prevents mesh migration, but helps to prevent the chronic pain syndrome associated with the peripheral trans-myofascial sutures placed in the traditional laparoscopic bridging mesh technique.

As recent studies have demonstrated, abdominal fascial continuity serves significant function in daily activities such as breathing, back support, posture, speech, etc. With this understanding of abdominal wall physiology in the setting of laparoscopic ventral hernia repair, which did not re-approximate the fascia, fascial closure has emerged as a new area of focus. We demonstrated that our patients have done well from the daily activity standpoint, which may be explained by our fascial closure technique.

One of most common complications after laparoscopic repair is seroma formation because the sac is not excised during a routine laparoscopic repair. However, if the fascia is closed and the sac is dissected and excised, we show that seroma formation and its related complaints were eliminated.

Because we were able to place a large mesh that overlaps the defect edge by at least 5 cm, the recurrence rate after

the hybrid procedure was low after 1 year (5%). Large mesh placement was made possible by the laparoscopic technique that was utilized.

This was a retrospective review of nineteen patients, which contains inherent selection bias, thus weakening our study. In order to evaluate the true physiological benefit of the procedure, more extensive questionnaires may need to be utilized. A prospective study with a larger sample size would evaluate the true efficacy of the hybrid technique more accurately.

## Conclusions

Hybrid ventral hernia repair has demonstrated the physiological benefit of fascial continuity by re-approximating the hernia edges. It has also shown to maximize the benefit of laparoscopic repair and minimize associated complications. Patients had no severe wound complications, a low recurrence rate, and minimal pain after the procedure, making the hybrid technique a safe alternative method when repairing intermediate sized ventral hernias.

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## Footnote

*Conflicts of Interest:* All authors have completed the ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/ales.2017.02.31>). The authors have no conflicts of interest to declare.

*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This manuscript was submitted to the IRB committee and was deemed as not needing IRB approval as well as not needing informed consent due to this manuscript being a retrospective chart review.

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