

Laparoendoscopic Single-Site Herniorrhaphy After Gynecologic Surgery

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ABSTRACT

Background and Objectives: Increased interest in laparoendoscopic single-site surgery has instigated research into trials of novel techniques. The procedure we propose may potentially improve patient satisfaction and cosmetic results while diminishing the incidence of trocar-site herniation. We report our initial experience with laparoendoscopic single-site totally extraperitoneal herniorrhaphy for postoperative incisional hernia to determine the procedure's feasibility and safety.

Methods: Three patients with incisional hernias after gynecologic surgery underwent laparoendoscopic single-site totally extraperitoneal procedures. We evaluated the patients' preoperative and postoperative condition, as well as the details of their original surgery. We performed the procedure through a 2-cm umbilical incision followed by mesh insertion and transabdominal suture placement in all patients.

Results: Laparoendoscopic single-site totally extraperitoneal herniorrhaphy was completed in 80 to 120 minutes. No intraoperative complications were encountered, and surgical blood loss was minimal. The duration of hospital stay ranged from 2 to 4 days. One patient had a postoperative wound infection. The patients have shown no sign of recurrence at 9 months' follow-up.

Conclusion: Laparoendoscopic single-site totally extraperitoneal herniorrhaphy appears to be feasible and safe. It may be performed with readily available instruments, although further experience and practice are warranted for a more efficient repair. The procedure has similar advantages to a multiport laparoscopic totally extraperi-

toneal procedure but yields better cosmetic results. More studies are needed to assess the long-term benefits and complications of this procedure.

Key Words: Herniorrhaphy, Single site, Laparoscopy, Extraperitoneal approach

INTRODUCTION

The incidence of incisional hernia after gynecologic laparoscopic surgery is 21 in 100 000, with 86.3% of cases occurring after surgery in which a 10-mm trocar was used.¹ With laparotomies, incisional hernias occur most commonly in midline incisions, with a 14% chance, as opposed to transverse laparotomies, with a 2% chance.² In 2011 a review by the Cochrane Collaboration concluded that laparoscopic herniorrhaphy reduced the risk of wound infections and decreased hospitalization time, though at a higher cost.³ No significant difference in postoperative pain, operative time, or recurrence rate was found.

Minimally invasive surgery has gradually evolved since the 1990s, and increasing popularity has resulted in the development of techniques and procedures. Since 1998, technical advancements have facilitated the performance of procedures such as appendectomy, cholecystectomy, and hysterectomy through a single port⁴⁻⁶; this technique is known as laparoendoscopic single-site (LESS) surgery. Currently, researchers and clinicians are still investigating the possibility of LESS surgery in numerous procedures.

Inguinal or abdominal hernia repair is a condition in which repair with LESS surgery is feasible. This technique has proven to be comprehensively superior to traditional laparotomy in terms of esthetics, recovery, and complications.⁷ The patient receives an enhanced cosmetic outcome because only one incision, often in the umbilicus, is used. Both recovery times and complication rates are significantly decreased because of the reduced number of wounds, which theoretically decreases postoperative wound pain, infection, bleeding, and adhesion formation.⁷⁻¹⁰

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The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

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DOI: 10.4293/JSLS.2014.00210

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The standard approaches to laparoscopic hernia repair are transabdominal preperitoneal and totally extraperitoneal (TEP) repair. TEP repair has the advantage of not requiring entry into the abdominal cavity; however, it has not been performed for an incisional hernia using the LESS technique. The difficulty posed by LESS surgery lies within a surgeon's lack of technical experience and the lack of specialized instruments that may be required to facilitate a short and simple operation; this could explain why the procedure is not widely performed. The objective of our study was to assess the feasibility and safety of a single-incision tension-free TEP repair, as well as to describe our experience.

MATERIALS AND METHODS

Three patients with incisional hernias after gynecologic surgery were selected over a 9-month period: 2 patients underwent laparoscopic procedures, and 1 patient underwent an open procedure. The mean patient age was 52.5 years (range, 36–69 years), and the mean follow-up period after the original surgical procedure was 4.75 months (range, 0.5–9 months). All patients were evaluated at an outpatient clinic and provided their informed consent after receiving information regarding the surgical technique and the risks associated with mesh hernia repair, as well as the complication rate of single-incision surgery.

Surgical Technique

Patients were administered general anesthesia with endotracheal intubation and then placed in the Trendelenburg position with their legs padded and supported in stirrups.

Umbilical Incision

By use of the Hasson technique, we made a 2-cm horizontal incision just below the lower margin of the umbilicus and deepened to the anterior rectus sheath. A horizontal incision was then made over the medial part of the anterior rectus sheath, and the rectus muscle was identified.

Establishing Single-Incision Port in Extraperitoneal Space

Using digital dissection, we opened the extraperitoneal space just below the umbilicus, between the rectus fascia and the rectus muscle. After creating the largest possible space, we inserted a glove port using the method described by Kim et al.¹¹ In brief, a small Alexis self-retaining wound retractor (Applied Medical Resources, Rancho Santa Margarita, California) was inserted into the extra-

peritoneal space, with its inner rim fixed against the rectus fascia and its outer rim draped with a surgical glove. One 10-mm cannula and two 5-mm cannulas were inserted through the fingers of the glove. A 5-mm, 30° endoscope (Karl Storz, Tuttlingen, Germany) was inserted through one of the 5-mm cannulas, and a 5-mm PlasmaKinetic cutting forceps system (Gyrus ACMI; Olympus, Tokyo, Japan), designed for laparoscopy, was inserted through the other 5-mm cannula.

Creating Extraperitoneal Space

We dissected the extraperitoneal space between the rectus fascia and the rectus muscle using the cutting forceps, and we identified the incisional hernia (**Figure 1**). We created a margin of at least 5 cm around the fascial defect in preparation for mesh placement. Pneumopreperitoneum was then created within the dissected space.

Identifying Hernia Sac

We identified and isolated the hernia sac from the fascia and soft tissues. The sac was kept intact during dissection to prevent collapse of the pneumopreperitoneum from gas leakage into the abdominal cavity.

Mesh Reinforcement

Before mesh insertion, we achieved and verified hemostasis. With digital palpation, we were able to identify the size and location of the defect and to ensure that there was a safe margin of ≥ 5 cm for mesh placement (**Figure 2**). We then inserted a mesh (Prolene, 6 in \times 6 in; Ethicon, Somerville, New Jersey) with the correct shape and size through the 10-mm cannula and extended it between the fascia and rectus muscle with an endoscopic grasper (**Figure 3**). The borders of the mesh were secured with 5 to 8 transabdominal sutures with an Endo Close suturing device (Covidien, Mansfield, Massachusetts).¹²

We removed all instruments, including the single-incision port, and closed the incisional wound in layers.

Treatment Protocol

One gram of prophylactic cefazolin was administered preoperatively; cefazolin and gentamicin were administered for 1 postoperative day. No oral antibiotics were prescribed thereafter if patients remained afebrile and without evidence of pelvic infection. Oral nonsteroidal anti-inflammatory drugs were routinely prescribed after surgery for pain management, with supplemental intramuscular nalbuphine, 30 mg, when needed.



Figure 1. The incisional hernia defect is shown after successful dissection of the extraperitoneal space between the rectus fascia and the rectus muscle with cutting forceps.

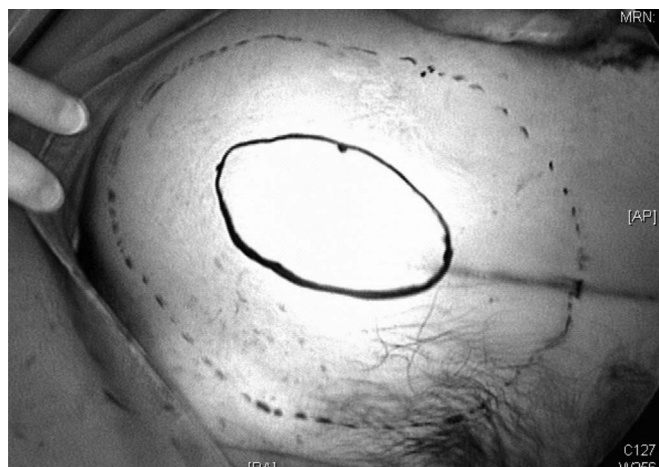


Figure 2. Superficial identification and marking of hernia defect (solid line), with estimation of mesh placement (dotted line) indicating a 5-cm mesh margin around defect.

The transabdominal sutures were left in place for 2 weeks to ensure adequate fibrin formation. They were then removed on the 14th postoperative day in an outpatient setting.

RESULTS

Three patients with incisional hernias were treated by the LESS TEP procedure. All cases were completed without the need for an additional port or conversion to open

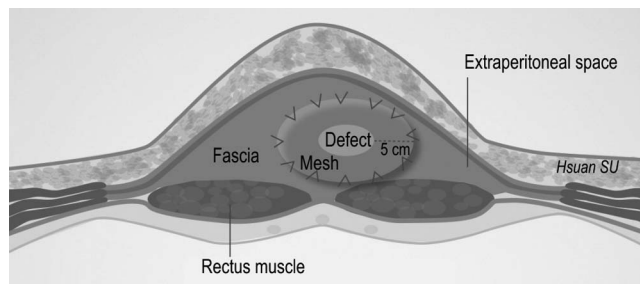


Figure 3. Incisional hernia defect located within extraperitoneal space. The mesh extends to a 5-cm margin around the defect. The mesh is reinforced with transabdominal sutures.

surgery. The surgical details are shown in **Table 1**. No major complications, such as great vessel injury, bladder injury, or bowel injury, occurred in any of the cases. One patient had a superficial wound infection and was treated with a local dressing with saline solution. Subcutaneous emphysema developed in all 3 patients and resolved completely with 6 hours. The duration of hospital stay ranged from 2 to 4 days. No recurrences or trocar-site hernias were found during the follow-up period.

DISCUSSION

Several methods are currently used for surgical mesh repair of incisional hernias: onlay, inlay, and underlay.

Table 1.
Surgical Details

Patient No.	Age (y)	Original Surgical Procedure	Incisional Hernia Location	LESS Access Site	Hernia Size (cm)	Operative Time (min)	Blood Loss (mL)	Length of Stay (d)	Follow-Up (mo)
1	69	Laparoscopic myomectomy	Left lower quadrant	Umbilicus	4 × 5	80	120	2	9
2	55	Abdominal hysterectomy	Right lower quadrant	Umbilicus	8 × 8	90	200	2	7
3	36	Laparoscopic enucleation of ovarian cyst	Umbilicus	Right lower quadrant	2 × 3	120	150	4	1

These terms refer to the placement of the mesh relative to the rectus muscle and fascia. In open surgery the onlay method results in a higher recurrence rate compared with the other methods (inlay and underlay), as well as a higher rate of complications such as the development of seroma.¹³ Most reports suggest that the underlay method is superior, although several researchers maintain that the onlay method still results in good surgical outcomes.¹⁴

Laparoscopic incisional herniorrhaphy is an alternative method for defects <10 cm in size; mesh reinforcement is necessary in laparoscopic repairs to minimize hernia recurrence. Most laparoscopic herniorrhaphies are performed with an intraperitoneal onlay mesh repair, with a high success rate and low complication rate.¹⁵ Nevertheless, the risk of bowel-related complications is not eliminated. Eid et al¹⁴ reported the outcomes of 79 laparoscopic ventral hernia repairs with 1 year of follow-up, with 1 case of prolonged ileus and 1 bowel injury.

Our technique for single-incision TEP herniorrhaphy is similar in concept to the underlay method, with the mesh positioned between the rectus fascia and the muscle. It theoretically encompasses the advantages of the underlay method, albeit with fewer intestinal complications because the abdominal cavity is not entered.

The feasibility of single-incision tension-free TEP repair was reported by Chung et al¹⁶ in a study of 100 patients who underwent a LESS TEP approach for inguinal hernias; they concluded that the procedure is feasible and safe with an acceptable surgical outcome. Laparoscopic repair provides a shorter postoperative recovery period, is tension free, decreases mesh erosion, and lowers tissue trauma, which subsequently reduces adhesion formation.^{7–10,17} The apparent motive for pursuing LESS surgery is its cosmetic result, with reduced scar formation.⁸ For this esthetic reason, we limited our incision size to ≤ 2 cm. In addition, by reducing the number of trocar sites and therefore the number of fascial defects, the risk of future

trocar hernia is reduced. Using video endoscopy within the preperitoneal space, we were able to visualize the hernia and to maneuver instruments through a single port without entering the abdominal cavity. This eliminates interference with and potential trauma to the bowel and hence lowers the incidence of adhesions.

We elected to use transabdominal sutures for better tensile strength,¹⁸ as well as for economic reasons, when compared with Tacker fixation (Covidien, MA, USA). However, at present, it remains debatable whether mesh fixation is absolutely necessary.¹⁹

Subcutaneous emphysema is a common complication associated with extraperitoneal laparoscopic procedures.^{16,20} The possible mechanism is the extravasation of carbon dioxide into the subcutaneous tissues through the leakage of trocar seals.²¹ Besides, prolonged operative time, use of higher insufflation pressure (>12 mm Hg), and use of multiple surgical ports (≥ 6) are also predisposing factors.²² Subcutaneous emphysema is a minor complication as long as hypercarbia and respiratory acidosis are not causing any harmful effect. Subcutaneous emphysema may be reabsorbed in a short time and easily managed by increasing the ventilation rate.^{20–22}

The disadvantage of LESS TEP repair, in our experience, is the loss of instrument triangulation and the subsequent crisscrossing of instruments. We attempted to adapt by maneuvering the operating table, using gravity and pneumoperitoneum to achieve triangulation. This is perhaps the most challenging element of the procedure in which extensive practice and technical development are required to efficiently perform this repair. We did not attempt to overcome this limitation by switching to different instruments because doing so would have increased the cost of the technique. Another limitation of this technique is similar to that of traditional laparoscopy in which a large defect would necessitate open repair because of

the inability to precisely position the mesh laparoscopically.

CONCLUSION

LESS TEP repair is feasible and safe for patients with incisional hernias. Our experience provides preliminary insight into this procedure, which could potentially be an alternative repair choice. However, insufficient data available at present prevent the drawing of definitive conclusions; further exploration in a large, prospective study with long-term follow-up is required to confirm our initial findings.

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