

# Transitioning to Single-Incision Laparoscopic Inguinal Herniorrhaphy

Danny A. Sherwinter, MD

## ABSTRACT

**Background:** Laparoendoscopic single-site surgery (LESS) offers cosmetic benefits and may represent further progress towards reducing the invasiveness of surgical interventions. We report our initial experience with LESS totally extraperitoneal (TEP) inguinal herniorrhaphy.

**Materials and Methods:** Beginning March 2009, we transitioned from a multiport laparoscopic TEP (MLH) technique to a single-incision TEP (SITE) technique. The first 52 consecutive patients who underwent SITE at our institution were compared with the preceding 52 MLH repairs.

**Results:** Of the first 52 patients undergoing SITE, there were no conversions to either open or multiport surgery. The mean operative time for the SITE cases did not differ significantly from that of MLH. Complications were equivalent between the 2 groups and included postoperative seroma and urinary retention.

**Conclusions:** Transitioning from MLH to SITE was readily accomplished without significantly altering operative time or morbidity.

**Key Words:** Laparoscopy, Inguinal hernia, Single Incision, Totally extraperitoneal.

## INTRODUCTION

Although originally described in 1992,<sup>1,2,3</sup> laparoendoscopic single-site surgery (LESS) went largely unexplored until becoming reinvigorated by the NOTES revolution. Resurrected initially as a stepping stone to NOTES,<sup>4</sup> LESS quickly began generating interest as a worthy innovation in and of itself. Single-incision surgery provides surgeons with the opportunity to offer scarless surgery to their patients today, without having to significantly change the laparoscopic paradigm or wait for tomorrow's innovations. No viscerotomy is needed with its inherent closure and contamination problems, the instrumentation is readily available, no novel skills or multi-specialty conglomerate is needed, and the procedures are readily coded and billed to insurance carriers. It is therefore little surprise that LESS has caught the attention of surgeons and patients alike and has led to an exponential growth of centers and surgeons offering this option to their patients.<sup>5</sup>

With over 800 000 inguinal hernia repairs performed in the United States<sup>6</sup> and 20 million performed worldwide annually,<sup>7,8</sup> this type of hernia is a significant public health concern. Open, tension free, mesh repair has long been the gold standard for inguinal herniorrhaphy (IH). This technique requires a sizeable skin incision and dissection, leading to poor cosmetic results, postoperative pain, and delayed return to activities of daily life (ADL). These concerns are not only vexing to patients but also are quite costly from a societal standpoint.

In contrast to virtually all other intraabdominal procedures, surgeons have been resistant to the adoption of laparoscopic inguinal herniorrhaphy (LIH). This has been primarily due to an extremely steep learning curve for an operation that yields only modest improvements in postoperative pain and disability<sup>9</sup> and is not associated with improved cosmesis. Add to this the increased cost of LIH<sup>10</sup> and open surgery is likely to remain the standard of care.

A major contributing factor to the perpendicular learning curve of LIH is the loss of traditional triangulation engendered by working in the tight preperitoneal space. This diminutive operating window allows only small incremental movements with instruments often held in-line to the scope's view. Because the major drawback of single-incision surgery is loss of triangulation,<sup>5</sup> we postulated

Maimonides Medical Center, Division of Minimally Invasive Surgery, Brooklyn, New York, USA.

The author would like to thank Dr M. Rovinsky for help with the illustrations.

Address correspondence to: Danny A. Sherwinter, MD, 948 48th Street, Brooklyn, NY, 11219, USA. Telephone: (718) 283-7952, Fax: (718) 635-7102, E-mail: DSherwinter@Maimonidesmed.org

DOI: 10.4293/108680810X12924466007485

© 2010 by JSLS, *Journal of the Society of Laparoendoscopic Surgeons*. Published by the Society of Laparoendoscopic Surgeons, Inc.

that surgeons who have already perfected these maneuvers in multiport LIH (MLH) may be able to transition rapidly to a single-incision approach without significantly increasing operative time or morbidity.

This report describes our initial experience with LESS totally extraperitoneal (TEP) inguinal herniorrhaphy (SITE).

## MATERIALS AND METHODS

A prospective database of all patients undergoing LIH was retrospectively reviewed. The first 52 patients who underwent 61 (25 right, 18 left, 9 bilateral) single-incision repairs were included in this review. We then compared them with the 52 patients who underwent standard multiport LIH immediately prior, for a total of 104 consecutive patients who underwent 126 repairs. Institutional review board approval was obtained.

### Technique

Other than port placement, both MLH and SITE used identical TEP approaches. In summary, all patients had a urinary catheter placed at the commencement of the case and received a single dose of perioperative antibiotics. All patients were maintained under general anesthesia with endotracheal intubation. Patients were placed supine with both arms tucked comfortably at their sides in a mild Trendelenburg position. Each case started with a lateral curvilinear incision within the umbilical fold. The subcutaneous fat was distracted and the anterior fascia of the rectus sheath visualized. The midline and an umbilical hernial defect, if present, were avoided, and the anterior rectus sheath entered sharply. A dissecting balloon system (Spacemaker, Covidien, Norwalk, CT) was used to create the preperitoneal space.

Insufflation of the preperitoneal space with 12mm Hg CO<sub>2</sub> was maintained while the dissection and subsequent mesh deployment (Parietex anatomical mesh, Covidien) was carried out. The mesh was secured with a tacking device (ProTack, Covidien). Once the procedure was completed, 0.25% bupivacaine with epinephrine was sprayed into the preperitoneal space and the space desufflated under direct vision. All trocars were removed and the fascial defect closed with braided absorbable suture.

The multiport cases were performed with the Spacemaker at the umbilicus and additional 11-mm and 5-mm trocars placed in the midline through separate skin incisions. The single-incision cases were performed based on availability either with a single-port system (SILS port, Covidien) or 3 separate ports through individual fascial incisions through a single skin incision at the umbilicus.

All patients received postoperative pain medications and were discharged home when they were awake, could tolerate liquids, and had adequate pain control. Urination prior to discharge was not a requirement.

Patients were instructed to return to full activities and their employment as soon as they felt able to do so. They were given a prescription for acetaminophen with codeine but encouraged to use it only sparingly. Patients were advised to return to the office for a 1-week and 1-month follow-up appointment.

## RESULTS

SITE was completed in all 52 patients with no conversions to multiport or open surgery.

The mean age of the patients was 35.6 (range, 18 to 61) and mean BMI was 25.2 (range, 16.3 to 35.0); 92% were men; 90 (86.5%) of the total cases were performed on primary hernias and 15 on recurrent (14.4%). Forty-eight percent of the hernias were on the right side, and 31% were on the left. Twenty-one percent were bilateral. Seventy percent were indirect, 30% direct, and 4.9% pantaloon. No femoral hernias were identified. The 2 groups were not significantly different in demographics or type of hernia (**Table 1**).

Mean multiport operative time was 48.2±10.8 minutes for unilateral hernia and 85.9±8.2 minutes for bilateral. Mean SITE operative time was 51.7±15.1 minutes for unilateral and 85.8±16.5 minutes for bilateral (**Table 2**).

Mean time to discharge from the ambulatory unit was 4.5 hours and not significantly different between the 2 groups. At home oral analgesia was used for a mean of 2.5 days, and the mean time to return to full ADL and work was 11.4 days. These parameters were not significantly different between the 2 groups (**Table 2**).

**Table 1.**  
Demographic Data

Demographic Data	MLH <sup>a</sup>	SITE <sup>a</sup>	
Age (y)	33.7 ± 11.3	37.5 ± 11.9	NS
Sex (male/female)	50/2	46/6	NS
BMI	25.6 ± 5.32	24.8 ± 5.34	NS
Side L/R/Bilateral	14/25/13	18/25/9	NS
Recurrent (%)	7 (13.5%)	8 (15.4%)	NS

<sup>a</sup>MLH=multiport laparoscopic totally extraperitoneal herniorrhaphy; SITE=single incision totally extraperitoneal inguinal herniorrhaphy; NS=not statistically significant.

**Table 2.**  
Perioperative, Postoperative, and Morbidity Data

Perioperative Data	MLH <sup>a</sup>	SITE <sup>a</sup>	
Operative time (min), Unilateral	48.2 ± 10.8	51.7 ± 15.1	NS
Operative time (min), Bilateral	85.9 ± 8.2	85.8 ± 16.5	NS
Time to discharge (min)	268.05 ± 94.79	274.11 ± 90.26	NS
Postoperative Data			
Narcotic requirement (days)	2.62 ± 1.17	2.44 ± 1.11	NS
Days to return to full activities	11.88 ± 6.07	10.94 ± 5.70	NS
Morbidity (%)	5 (9.6)	6 (11.5)	NS
Seroma formation (%)	4 (7.7)	3 (5.8)	NS
Delayed return of bladder function (%)	1 (2.0)	3 (5.7)	NS

<sup>a</sup>MLH= multiport laparoscopic totally extraperitoneal inguinal herniorrhaphy; SITE= single-incision totally extraperitoneal inguinal herniorrhaphy; NS=not statistically significant.

All patients were discharged the same day as their surgical procedure, and all but one were seen at least once in the postoperative period. Only 71% (74/104) of the patients kept their one-month appointment. In this short-term follow-up, no recurrences were identified.

Only minor complications were reported in our study group and included postoperative delayed return of bladder function and swelling of the hernia site secondary to a seroma/hematoma (**Table 2**).

No major complications or deaths were identified in our study population.

## DISCUSSION

Laparoscopic TEP IH is a procedure with an extremely steep learning curve. One report suggests completion of as many as 250 cases before the recurrence rate approaches that of open surgery.<sup>11</sup> This gives LIH the distinction of being the most demanding endoscopic operation. Laparoscopic inguinal hernia's level of complexity arises from 2 sources: first is the difficulty in recognizing the 3-dimensional anatomical landmarks of the groin from the inside-out<sup>12</sup>; second is the host of technical difficulties unique to LIH, specifically:

1. LIH is performed in the claustrophobic preperitoneal space, which almost eliminates triangulation;
2. The visual field is limited;
3. The surgeon is often forced to operate with only one working hand.

These technical hurdles closely match those identified as the basis for the steepness of the learning curve of *all* LESS

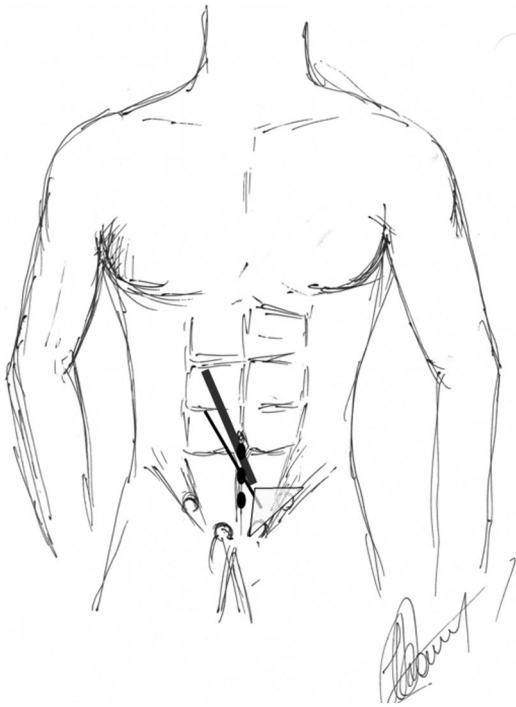
procedures.<sup>5</sup> Because of this, surgeons who have mastered the technical challenges of standard LIH should find it easier transitioning to SITE. Our findings of equivalent mean operative times in both the SITE and MLH groups support this contention. **Figures 1 and 2** illustrate the similarity in instrument positioning encountered in both SITE and MLH.

In contrast to LIH, the multiple access points of standard laparoscopic cholecystectomy provide unmatched triangulation, visualization, and instrument maneuverability (**Figure 3**). Losing these advantages because of a single access point (**Figure 4**) requires the acquisition of a new skill set specific to LESS and leads to a significant increase in operative times.<sup>13</sup>

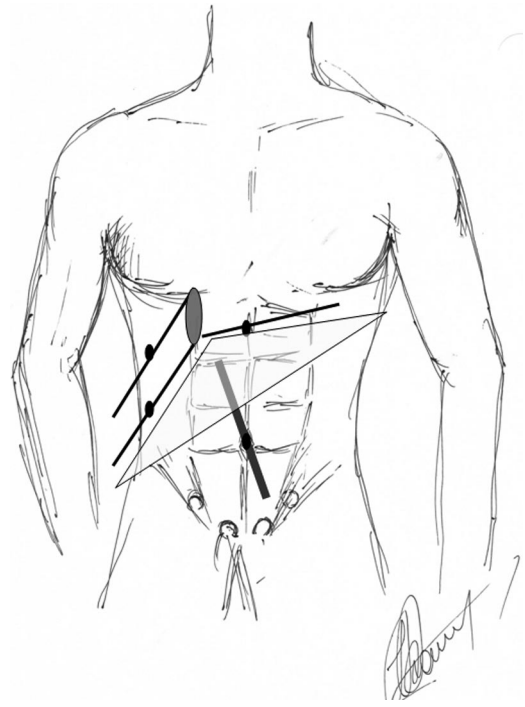
One other reason IH may be an especially good application for LESS is that IH is a common operation in the younger demographic, a group that places more emphasis on cosmesis. As in the early days of laparoscopic cholecystectomy, LESS will be consumer driven, making the target population an important factor in procedure adoption. For the first time, SITE will offer patients the option of essentially scarless inguinal herniorrhaphy (**Figure 5**).

In our practice, patients are carefully selected before being offered any form of laparoscopic herniorrhaphy. This is reflected in the low BMI and age of the patients in both groups. There was no significant difference in demographics of the patients chosen, or type of hernia repaired (recurrent, side, or bilaterality). Also the consecutive nature of the patients chosen prevented a significant impact of selection bias.

The mean operative times for both MLH and SILS in this study were similar to that described in a large series



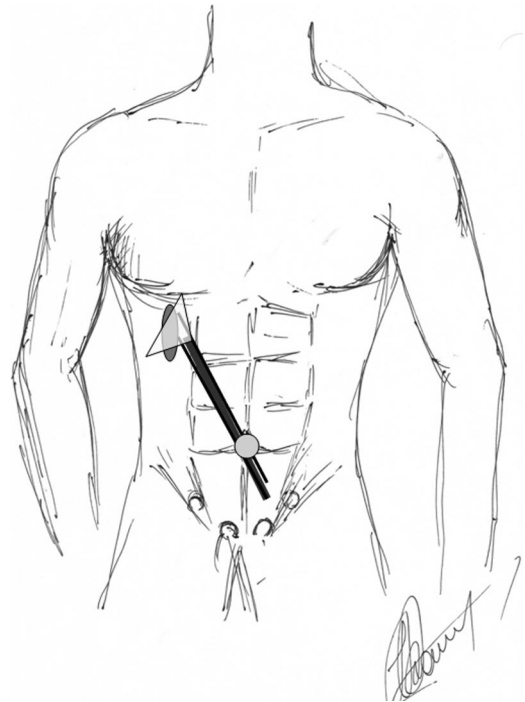
**Figure 1.** Multiport totally extraperitoneal inguinal herniorrhaphy schematic (thick line=camera, thin lines=instruments).



**Figure 3.** Multiport laparoscopic cholecystectomy schematic (thick line=camera, thin lines=instruments).



**Figure 2.** Single-incision totally extraperitoneal inguinal herniorrhaphy schematic (thick line=camera, thin lines=instruments).



**Figure 4.** Single-incision laparoscopic cholecystectomy schematic (thick line=camera, thin lines=instruments).



**Figure 5.** Postoperative photo of a patient 1 week after undergoing single-incision totally extraperitoneal inguinal herniorrhaphy (SITE).

comparing TEP to Lichtenstein repair.<sup>14</sup> Also rates of minor morbidity including delayed return of bladder function and seroma/hematoma formation were equivalent to those reported in other series of standard MLH repairs.<sup>14,15</sup>

This study has a number of limitations. This is a retrospective review with only short-term follow-up precluding a conclusion regarding recurrence rate, the most essential issue in hernia repair. Also, only one surgeon's experience is reported. Perhaps, others, with varied techniques and skills will have a more difficult time transitioning to SITE.

## CONCLUSION

Whether any LESS procedure in contrast to standard laparoscopy bestows any patient benefit other than improved cosmesis remains a matter of speculation and awaits larger trials and more sensitive evaluation tools.<sup>16</sup> This study supports the theory that SITE is not significantly more difficult than MLH and with the added benefit of scarlessness, SITE may finally provide the impetus that launches laparoscopic herniorrhaphy past open IH and into the mainstream.

## References:

1. Pelosi MA, Pelosi MA 3rd. Laparoscopic appendectomy using a single umbilical puncture (minilaparoscopy). *J Reprod Med.* 1992;37: 588–594.
2. Navarra G, Pozza E, Occhionorelli S, Carcoforo P, Donini I. One-wound laparoscopic cholecystectomy. *Br J Surg.* 1997;84:695.

3. Piskun G, Rajpal S. Transumbilical laparoscopic cholecystectomy utilizes no incisions outside the umbilicus. *J Laparoendosc Adv Surg Tech A.* 1999;9(4):361–364.
4. Elazary R, Khalaileh A, Zamir G, et al. Single-trocar cholecystectomy using a flexible endoscope and articulating laparoscopic instruments: a bridge to NOTES or the final form? *Surg Endosc.* 2009;23:969–972.
5. Gill IS, Advincula AP, Aron M, et al. Consensus statement of the consortium for laparoendoscopic single-site surgery. *Surg Endosc.* 2010;24(4):762–768.
6. Rutkow IM. Demographic and socioeconomic aspects of hernia repair in the United States in 2003. *Surg Clin North Am.* 2003;83(5):1045–1051, v-vi.
7. Kingsnorth AN, LeBlanc KA. Hernias. inguinal and incisional. *Lancet.* 2003;362:1561–1571.
8. Kingsnorth AN, LeBlanc KA. *Management of Abdominal Hernias.* 3rd ed. London, New York: Edward Arnold; 2003;40–47.
9. Eklund A, Rudberg C, Smedberg S, et al. Short-term results of a randomized clinical trial comparing Lichtenstein open repair with totally extraperitoneal laparoscopic inguinal hernia repair. *Br J Surg.* 2006;93(9):1060–1068.
10. Eklund A, Carlsson P, Rosenblad A, et al. Swedish Multicentre Trial of Inguinal Hernia Repair by Laparoscopy (SMIL) study group. Long-term cost-minimization analysis comparing laparoscopic with open (Lichtenstein) inguinal hernia repair. *Br J Surg.* 2010;97(5):765–771.
11. Neumayer L, Giobbie-Hurder A, Jonasson O, et al. Veterans Affairs Cooperative Studies Program 456 Investigators. Open mesh versus laparoscopic mesh repair of inguinal hernia. *N Engl J Med.* 2004;350(18):1819–1827.
12. Brick WG, Colborn GL, Gadacz TR, Skandalakis JE. Crucial anatomic lessons for laparoscopic herniorrhaphy. *Am Surg.* 1995;61(2):172–177.
13. Rivas H, Varela E, Scott D. Single-incision laparoscopic cholecystectomy: initial evaluation of a large series of patients. *Surg Endosc.* 2010;24(6):1403–1412.
14. Thill V, Simoens C, Smets D, Ngongang C, da Costa PM. Long-term results of a non-randomized prospective mono-centre study of 1000 laparoscopic totally extraperitoneal hernia repairs. *Acta Chir Belg.* 2008;108(4):405–408.
15. Fitzgibbons RJ, Jr., Camps J, Cornet DA, et al. Laparoscopic inguinal herniorrhaphy. Results of a multicenter trial. *Ann Surg.* 1995;221(1):3–13.
16. Chamberlain RS, Sakpal SV. A comprehensive review of single-incision laparoscopic surgery (SILS) and natural orifice transluminal endoscopic surgery (NOTES) techniques for cholecystectomy. *J Gastrointest Surg.* 2009;13(9):1733–1740.