

Laparoendoscopic Single-Site Hysterectomy: Tips and Tricks

Stuart Hart, MD; Patrick Yeung Jr, MD; Craig J. Sobolewski, MD

Using newer instrumentation and adhering to the basic principles of laparoendoscopic single-site (LESS) surgery may help the gynecologic surgeon avoid some of the pitfalls associated with LESS hysterectomy.

The laparoscopic approach to hysterectomy has become widely accepted as an alternative to open surgery. Since 1989, when the first total laparoscopic hysterectomy was performed, multiple advantages of this approach have been noted, including decreased postoperative pain, fewer wound infections, a smaller drop in postoperative hemoglobin levels, shorter hospital stay with quicker return to normal activities, and improved postoperative quality of life.¹⁻³

Recent advances in surgical techniques and instrumentation now allow the surgeon to perform a total laparoscopic hysterectomy through a single umbilical port. The LESS hysterectomy offers the following advantages: fewer abdominal incisions, improved cosmesis, possible decreased postoperative pain, and improved recovery (Table). In 1991, Pelosi et al reported the first laparoscopic hysterectomy with bilateral salpingo-oophorectomy using a single umbilical puncture instead of multiple ports.⁴ This approach was not widely accepted at the time due to the many inherent challenges of the procedure and the lack of appropriate technology and instrumentation.^{5,6}

Some challenges of LESS surgery include the loss of instrument triangulation and reduced operative working

space, which can result in instrument crowding and collisions (“sword fighting”). Introducing the laparoscope and

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surgical instruments in a parallel approach through the same incision can decrease both intra-abdominal and ex-

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TABLE. LESS Hysterectomy

Procedure	Operative Time	Estimated Blood Loss	Complications	Postoperative Pain
LAVH (n=50) vs LESS LAVH (n=50) ¹	127 min ±22.2 vs 122 min ±40.0	166.4 ±92.3 vs 146.2 ±124.8	No difference	Decreased with LESS procedure
TLH (n = 105) vs LESS TLH (n = 52) ²	110 min (45-253) vs 117 min (54-195)	150 (30-750) vs 100 (20-600)	No difference	Decreased with LESS procedure
LAVH (n = 43) vs LESS LAVH (n = 43) ³	124 min ±63 vs 119 min ±32	378 ±369 vs 369 ±312	No complications in either group	Decreased with LESS procedure

Abbreviations: LAVH, laparoscopic-assisted vaginal hysterectomy; LESS, laparoendoscopic single-site; TLH, total laparoscopic hysterectomy.

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FIGURE 1. TriPort+™ multi-channel single port. Image courtesy of © 2011 Olympus America, Inc. All rights reserved.

ternal operative working space and reduce visualization and triangulation. Newer instruments, including single-incision laparoscopic ports, articulating laparoscopic instruments, and automated suturing devices, allow the surgeon to accommodate for some of these challenges.⁷⁻¹⁰

Surgical Ports

Initially, LESS surgery was performed through a single umbilical skin incision in which multiple ports were placed through separate fascial incisions.

The development of single-port systems specific to LESS surgery has facilitated both abdominal entry and instrument mobility. A summary of the

LESS ports currently available in the United States follows.

The TriPort+™ Access System (Olympus America, Center Valley, PA) permits the placement of up to 3 laparoscopic instruments and can accommodate two 5-mm and one 12-mm instrument (Figure 1). The QuadPort™ (Olympus America, Center Valley, PA) allows for up to 4 instruments and can accommodate one 5-mm, two 10-mm, and one 12-mm instrument. The instrument shafts should be lubricated for ease of movement through the gel valves.

The SILS™ port (Covidien, Norwalk, CT) is a single-piece, flexible port made from a sponge-like elastic polymer. This port can accommodate three 5-mm instruments or two 5-mm and one 5/12-mm port. These ports are interchangeable. Once the incision is made, a curved retractor (“S” retractor) may be placed within the inferior aspect of the incision to “shoehorn” the port in place (Figure 2).

The AirSeal® port (SurgiQuest, Orange, CT) appears similar to other rigid



FIGURE 2. SILS™ port. Copyright © 2011 Covidien. All rights reserved. Used with the permission of Covidien.



FIGURE 3. The AirSeal® port. Image courtesy of © 2011 SurgiQuest, Inc. All rights reserved.

laparoscopic trocars but lacks an inner mechanical valve. Pneumoperitoneum is maintained by a pressure gradient created within the housing of the trocar; the pressure gradient within the port exceeds the pressure in the abdominal cavity created by the pneumoperitoneum. The system uses a specialized air pump and tubing that circulates air through a filter to remove smoke. The system also allows oddly shaped or traditional instruments to

be used without the limitations of traditional ports (Figure 3).

The S-PORTAL® product line (Karl Storz-Endoskope, Tutlingen, Germany), includes a variety of long, specially curved instruments and reusable peritoneal access ports.

the cannulas can move independently. This cap can be removed and replaced during the procedure, which facilitates specimen retrieval without removing the entire port (Figure 5).

The Single Site Laparoscopy (SSL) Access System (Ethicon Endo-Surgery, Cincinnati, OH) uses technology from a hand-assist device. The seal cap is fixed to an abdominal wall retractor. The 2-cm retractor can be used in patients with an abdominal wall thickness of less than 4 cm, and the 4-cm instrument can be used in patients with an abdominal wall thickness between 4 and 7 cm. The cap contains one 5/15-mm and two 5-mm channels.

Surgical Instruments

Various surgical devices are available that allow surgeons to compensate for some common problems associated with the LESS hysterectomy procedure such as the loss of triangulation, decreased working space, and instrument clashing.

Uterine Manipulators

The ability to manipulate the uterus is

The X-CONE® consists of 2 metal halves that are joined together by a silicone cap once it is placed within the peritoneal cavity. The cap has 3 access channels that can accommodate instruments up to 12-mm in diameter. The ENDOCONE® has channels for six 5-mm instruments and two 12-mm instruments (Figure 4).

The GelPOINT® Advanced Access Platform single-incision system (Applied Medical, Rancho Santa Margarita, CA) incorporates the Alexis® wound retractor with the GelSeal® cap. The GelSeal cap provides a PseudoAbdomen™ platform that floats above the fascial incision, allowing for a flexible fulcrum around which

very important during LESS surgery. In traditional multiport laparoscopic hysterectomies, the uterus can be manipulated using a laparoscopic grasper through any auxiliary port. This type of manipulation is challenging during a LESS procedure because the surgeon uses a parallel approach to insert the instruments through a single multichannel port. This may result in decreased operative working space and instrument collision.⁷ Using a uterine manipulator in place of an auxiliary port enables full manipulation of the uterus and reduces the instrument limitations imposed by using a single-incision port.

Some commonly used uterine manipulators include the RUMI[®] Uterine Manipulator with KOH Colpotomizer[™] (CooperSurgical, Trumbull, CT), Pelosi Uterine Manipulator (Apple Medical Corporation, Marlborough, MA), and the VCare[®] Uterine Manipulator (ConMed Corporation, Utica, NY). The RUMI and VCare uterine manipulators both contain a colpotomy cup that assists with lateral displacement of the ureters, anterior displacement of the bladder off the cervix, and delineation of the cervico-vaginal junction.

Articulating Instruments

These instruments are invaluable in creating internal instrument triangulation, which assists the surgeon with appropriate tissue manipulation and helps prevent instrument collisions. Because surgical instruments are introduced in a parallel manner, it is essential that at least 1 instrument—and preferably 2—is able to articulate.

Internal triangulation is most effectively created when the instruments are crossed intraperitoneally and appropriately articulated so that the instrument is aligned with the tissue. This often results in an



FIGURE 4. Karl Storz ENDOCONE[™] and X-CONE[™] ports. Images courtesy of © Karl Storz – Endoskope.

opposing instrument handle and tip, with the surgeon controlling tissue on the opposite side from the external location of the instrument handle. The surgeon can then maximize the use of his or her non-dominant hand, eg, the left hand may be controlling an instrument that is manipulating tissue from the right hand and vice versa.

Although this may be counterintuitive for the traditionally trained laparoscopic surgeon, this type of instrument and tissue manipulation is often necessary to effectively perform a LESS hysterectomy.

There are several articulating instruments available for use in LESS hysterectomy, including Cambridge Endo laparoscopic instruments (Framingham, MA), Covidien Roticulator[™], and SILS[™] Hand Instruments (Figure 6). These 5-mm laparoscopic devices provide an articulating distal tip with rotation.

The ultrathin, 2.3-mm percutaneous MiniLap instrument (Stryker, Kalamazoo, MI) allows for insertion without a scalpel incision, thus minimizing visible scarring. Since the MiniLap instrument is placed through separate abdominal incisions, it allows the surgeon to preserve the principles of triangulation



FIGURE 5. GelPOINT™ Advanced Access Platform. Image courtesy of © 2011 Applied Medical Resources Corporation. All rights reserved.



FIGURE 6. Covidien SILS™ Hand Instrument. Copyright © 2011 Covidien. All rights reserved. Used with the permission of Covidien.

and may assist in the LESS hysterectomy procedure, especially during a more difficult surgical case.

Using a flexible-tip laparoscope during a LESS procedure allows the surgeon to easily manipulate the laparoscope to avoid instrument collisions. Because flexion is provided at the distal tip, the handle and rod of the laparoscope can be positioned flat against the patient's external abdomen, while the internal flexible tip can be positioned up against the anterior abdominal wall and angled downward toward the operative site. This prevents the laparoscope from interfering with the other instruments within the crowded space above and below the single-incision port and may reduce instrument clashes by increasing operative working space. Since the flexible-tip laparoscope has handle controls that allow deflection at the tip in multiple directions, the laparoscope can remain in a single position throughout most of the procedure, while allowing for adequate visualization.

Two flexible-tip laparoscopes are widely used in LESS procedures. The Olympus EndoEYE™ is a 5-mm flexible

endoscope with a distally mounted CCD chip. The IDEAL EYES HD (Stryker, Kalamazoo, MI) is a 10-mm articulating high-definition endoscope with a friction-assist brake in the handle to fix the distal tip in position without the need for a locking mechanism. Although flexible-tip laparoscopes provide significant benefits over traditional rigid-angled scopes, using a 30- or 45-degree angled rigid bariatric scope with a right-angle light connector allows the surgeon to keep the camera away from the working space above the port.

Laparoscopic Holding Systems

A holding system allows the surgeon to operate more efficiently. The Wingman pneumatic-driven scope-holding system (Stryker, Kalamazoo, MI) fixes the laparoscope in place during the procedure, which frees up the surgeon's other hand and allows him or her to operate more efficiently. The ViKY® robotic laparoscope holder (EndoControl Medical, La Tronche, France) offers laparoscopic manipulation through voice recognition or foot-switch control. The FreeHand® laparoscopic camera controller (ProSurgics, Cupertino, CA) also allows for

hands-free movement of the laparoscope through a robotic platform that uses the surgeon's head movement and an activation controller.

LESS Hysterectomy Techniques

There are several techniques that the surgeon can use to perform a safe and efficient LESS hysterectomy. Some of these techniques depend on the availability of the instruments and include abdominal entry techniques, the use of "plane-ing" to avoid instrument collisions, and vaginal-cuff closure techniques.

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Two incisions are typically used to accommodate a LESS port during abdominal laparoscopic entry: an omega incision and a linear incision directly through the center of the umbilicus.

Two incisions are typically used to accommodate a LESS port during abdominal laparoscopic entry: an omega incision and a linear incision directly through the center of the umbilicus. The omega incision is U-shaped and follows the natural curve of the inferior aspect of the umbilicus at the base, with the arms of the omega extending vertically upward. The goal is to maximize the opening of the incision while keeping the incision line below the edges of the umbilical crater, thus reducing any visible scar. The linear incision, which can be made in any orientation through the center of the umbilicus, is usually made in a vertical manner and tailored to the natural creases of the skin and umbilicus. Regardless of the entry technique, the fascial edges should be tagged with suture for traction prior to port placement; this can facilitate fascial closure at

the end of the procedure. The preferred LESS port can then be placed according to the manufacturer's recommendations.

To avoid collisions, the surgeon should use laparoscopic instruments that are small in diameter, instruments with small handles, and articulating instruments. The use of "plane-ing" during a LESS hysterectomy is important because it allows for efficient instrument manipulation.

To understand this concept, imagine that the space above the patient's abdomen contains a 3-dimensional cube with 3 sets of planes on the x, y, and z axis (like a 3 in x 3 in Rubik's cube): 3 heights above the abdominal wall (lowest, middle, and highest planes), 3 planes relative to midline (center, left, and right), and 3 depths above the umbilicus. The laparoscope's camera head can be placed against the external anterior abdominal wall or at the lowest possible height. The handles of the graspers can retract tissue in the middle height but away from the center, to avoid instrument and handle collisions. In this manner, the operating hand (which usually holds the energy device) can move unencumbered in the center—at the highest height—without instrument clashing.

Closing the vaginal cuff during a LESS hysterectomy can be challenging. Traditional laparoscopic suturing techniques can be performed using a straight-needle driver and an articulating grasper, or vice versa. Automated suturing devices such as the Endo Stitch™ (Covidien, Norwalk, CT) or the articulating SILS™ Stitch (Covidien, Norwalk, CT), provide a more reliable and efficient method for cuff closure without the problems associated with traditional suturing.

These instruments allow a small, straight needle to pass back and forth through the desired tissue to perform efficient suturing. The vaginal cuff can be closed with either an interrupted figure-of-8 suture or running suture. Using a longer suture (36 in or 48 in) allows the surgeon to pull the suture out between tissue bites so that traction can

be maintained extracorporeally. This is important during a LESS hysterectomy because of the reduced ability to effectively manipulate tissue.

Conclusion

Although there are many challenges to performing a LESS hysterectomy, the benefits of this procedure can be achieved with the use of appropriate techniques. Adhering to the basic principles of LESS surgery and using state-of-the-art devices can assist the gynecologic surgeon in adopting this approach despite the steep learning curve and counterintuitive instrument movements.

The authors are each consultants/speakers for Covidien. Dr Hart is also a consultant/speaker for Boston Scientific and Stryker. Dr Sobolewski is a consultant for TransEnterix.

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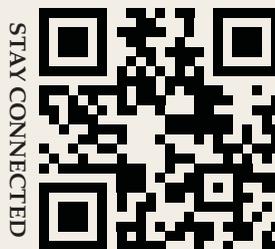
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