Laparoendoscopic Single-Site Surgery: LESS, General Indications

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Contents

17.1 **Introduction** 157
17.2 **Terminology** 158
17.3 **History of LESS** 158
17.4 **LESS Instruments and Technology** 159
17.4.1 Access Devices 159
17.4.2 Optics 160
17.4.3 Active Instruments and Graspers 160
17.5 **Essentials in the Procedure of Laparoendoscopic Single-Site Surgery** 160
17.6 **Status of LESS in Gynecology** 161
17.7 **Indications for LESS** 162
Conclusion 162
References 162

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17.1 Introduction

Laparoscopic surgery has gained increasing acceptance as a preferred surgical modality for the performance of a variety of gynecologic procedures, due to its many advantages, including shorter hospital stay, less pain, more rapid postoperative recovery, and better cosmetic results compared with traditional laparotomy.

In an effort to reduce abdominal wall trauma and obtain better cosmetic results, reduction in port size and optic and instrument diameter has been employed. In most procedures however, morcellator and/or specimen extraction are required; therefore, a minimum one port of 10–20 mm is needed in most gynecologic procedures. Specimen extraction through the umbilicus leads to less pain than extraction via a lateral port (Cho et al. 2012), and the umbilicus is the thinnest part of the abdominal wall and is relatively avascular.

Special access devices and special optics and instruments have now made it possible to perform laparoendoscopic single-site (LESS) surgery through the umbilical incision alone. The total length of the umbilical incision required to perform LESS surgery is often the same as the incision needed to perform specimen extraction in traditional laparoscopy. In these cases, two or three ports are avoided by using the LESS technique.

This LESS technique is cosmetically preferable to the multiple incisions associated with conventional laparoscopy, since the only scar

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Fig. 17.1 Cosmetic result immediately after surgery

is concealed within the umbilicus (Fig. 17.1). Reports in the gynecology literature have demonstrated the feasibility and safety of the procedure, and if these findings are confirmed, LESS may, in accordance with "the spirit of minimally invasive gynecology," become an alternative standard of care in the treatment of several benign and oncologic gynecologic conditions. In this chapter, laparoendoscopic single-site surgery will be described in more detail. In Chap. 20, the safety of the procedure, learning curve, and future directions of LESS will be described.

17.2 Terminology

Various terminologies have been used to describe laparoscopic surgical procedures performed through a single incision or surgical site. In 2008, an international consortium of minimally invasive experts (the Laparoscopic Single-Site Surgery Consortium for Assessment and Research) met, with the goal of standardizing the terminology for academic communications and to avoid using industry and trade names. More than 10 terms to describe surgery through a single incision were identified (Table 17.1). The conclusion of this consortium was to utilize the term "LESS surgery" to describe all procedures performed in a minimally invasive manner through a single incision.

Table 17.1 Categorization for laparoendoscopic single site

Acronym	Full procedure name
LESS	Laparoendoscopic single-site surgery
Opus	One-port umbilical surgery
NOTES	Natural orifice transluminal endoscopic surgery
RSP	Robotic single-port surgery
SILS	Single-incision laparoscopic surgery
SIMIS	Single-incision minimally invasive surgery
SLIT	Single laparoscopic incision transabdominal surgery
SPA	Single-port access
SPL	Single-port laparoscopy
SPICES	Single-port incisionless conventional equipment-utilizing surgery
U-LESS	Umbilical laparoendoscopic single-site surgery

Universal term selected by the international consortium the Laparoendoscopic Single-Site Surgery Consortium for Assessment and Research—LESSCAR in 2008

17.3 History of LESS

Simple gynecological procedures have been performed via the LESS approach for more than four decades. Three thousand six hundred cases of laparoscopic sterilization using LESS technique were reported by Wheeless et al. as early as 1973. The first hysterectomy was reported in 1991, but not until 2008 was a subsequent series of LESS gynecologic procedures reported in the literature. Since then, the number of procedures performed and described has grown exponentially (Fader et al. 2010; Escobar et al. 2010a, b; Chen et al. 2011; Cho et al. 2012; Fanfani et al. 2010; Yim et al. 2010), and in the last 2 years, several randomized trials have been published (Chen et al. 2011; Cho et al. 2012; Fagotti et al. 2011; Li et al. 2012).

A similar trend has been seen in general surgery. The first series of LESS cholecystectomy was described in 1997 and appendectomy in 2007. In urology, the first small series of nephrectomies were described in 2007. Randomized trials have now been performed.

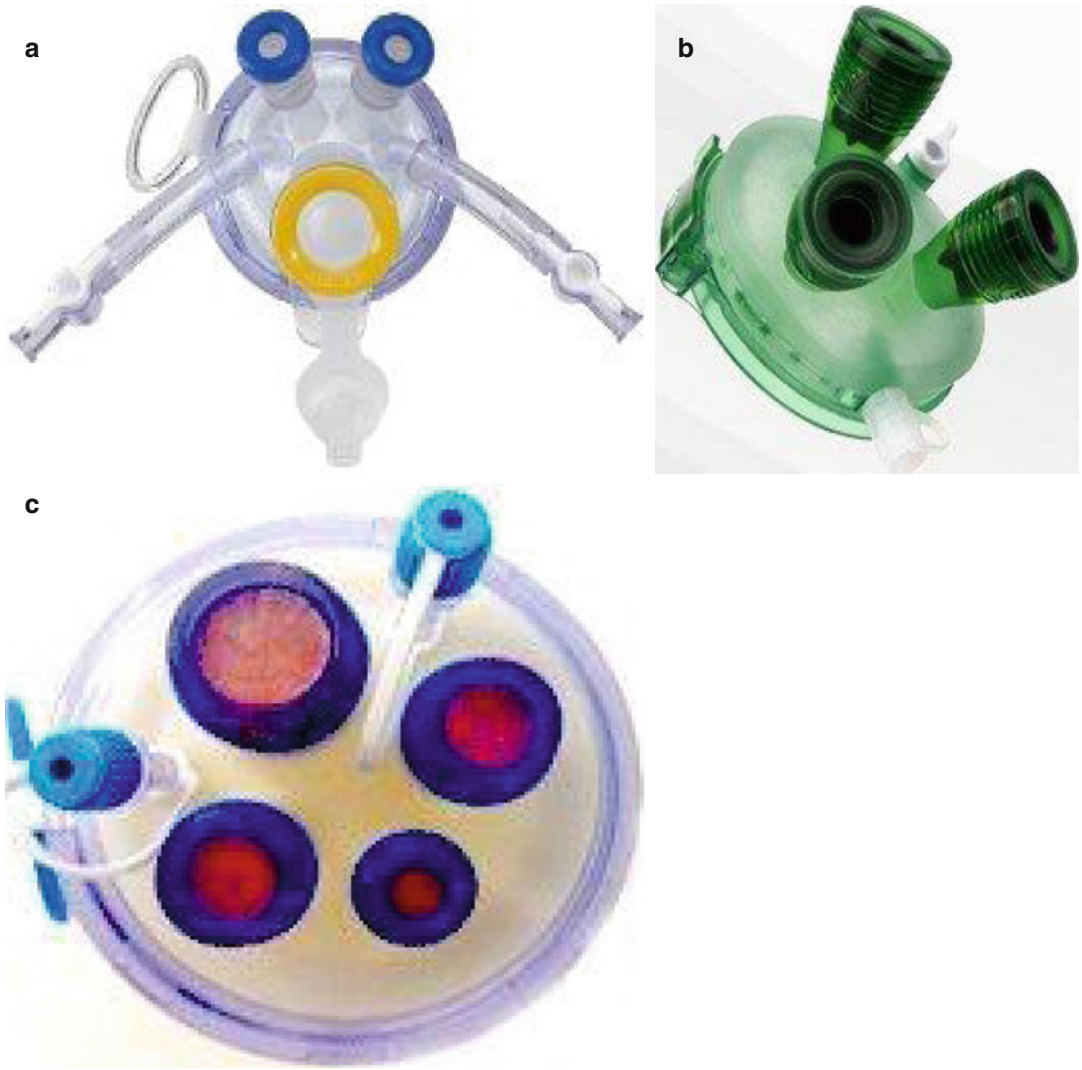

Fig. 17.2 (**a**) TriPort 15. (**b**) QuadPort. (**c**) GelPOINT

17.4 LESS Instruments and Technology

17.4.1 Access Devices

The development of access devices, allowing passage of three or more instruments through a single small incision, together with channels for CO_2 insufflation and smoke evacuation, has been the key to the fast development of this novel laparoscopic surgical modality.

Minimally invasive surgery requires an access device which allows passage of instruments and gas using the smallest possible incision. Devices using a retracting component consisting of an inner and outer ring with a thin plastic sleeve obtain this goal optimally since all space created by the incision can be used for instruments and specimen removal (TriPort 15, QuadPort, GelPOINT (Fig. 17.2)). In the newest devices, the valve system allows passage of the optic and instruments, comparable to standard trocars, and

accommodates 5–15 mm instruments, including morcellator. Reusable devices on the market consist of a solid casing, enabling the optic and instruments to pass, which requires a relatively larger fascial incision.

17.4.2 Optics

LESS surgery can be performed with several types of optics. However, a small diameter scope (5 mm or smaller) reduces the abdominal trauma and enhances surgeon ergonomics by reducing the required length of the umbilical incision and limiting the extracorporeal instrument "sword fighting" that occurs with an "in-line" surgical approach. Conventional laparoscopes have a large extracorporeal profile with light cable perpendicular to the telescope, and this increases the risk of instrument clashing. This problem can be reduced with a 90° angle on the tip of the light cable. To further avoid instrument crowding and in-line visualization and increase the overview of the operative field, using a rotatable 30 or 45° laparoscope, preferably with a flexible tip, is critical. However, if accessible, a 5 mm, angled lower-profile camera system, with light cable in line with the shaft of the telescope, is also available (EndoEYE laparoscope (Olympus Germany/America) (Fig. 17.3).

Fig. 17.3 EndoEYE 5 mm with light cable in line and cutting forceps in "gangsta" position

17.4.3 Active Instruments and Graspers

Special single-site instruments have been introduced, including curved and/or flexible instruments. These instruments, principally 5 mm, allow for intracorporeal triangulation, which provides the illusion of extracorporeal triangulation that is the tenet in traditional laparoscopy. Several single-site graspers are on the market, and in combination with an angled optic and a uterine manipulator, a traditional straight active instrument offers the best performance and is recommended in most cases.

17.5 Essentials in the Procedure of Laparoendoscopic Single-Site Surgery

Most single-port devices must be placed by an open access technique. The Hasson technique or a modification of this is recommended. The Hasson technique has been proven safe. After a 1.5–2.0 cm longitudinal transumbilical skin incision is made, the subcutaneous fat is opened, and the fascia elevated upward with two Kocher clamps. The fascia is incised between the clamps, and a blunt retractor is inserted through the peritoneum into the peritoneal cavity. The final placement of the port differs between the different devices. In order to avoid lesions of the bowel, an ultrasound over the umbilicus preoperatively during deep inspiration and expiration may be helpful in evaluating the presence of umbilical adhesions.

Instrument crowding and external instrument clashing may occur due to several instruments being passed through a single port. As mentioned above, unique single-port curved instruments are available, and utilization of a curved grasper and an angled optic, combined with a straight (or curved) active instrument, reduces this problem significantly and even makes triangulation possible. It is important to maintain the laparoscope and surgical instruments in different horizontal planes (Fig. 17.4),

Fig. 17.4 Camera, cutting forceps, and grasper in three different planes during operation

with attention to keeping at least one of the instrument handles horizontal and parallel to the floor ("gangsta") to reduce the problem of instrument clashing further (Fig. 17.3). It is recommended to place the grasper in correct position and then consider whether the active instrument has to pass over or under the grasper, before it is introduced. In gynecology, one grasper is often sufficient due to the possibility of utilizing a high-quality uterine manipulator, which is highly recommended and provides additional adequate traction-countertraction during pelvic procedures.

Multifunctional instruments, which grasp, coagulate, and cut, reduce the number of instrument movements and exchanges and are especially helpful in LESS surgery.

Closure of the umbilical incision must be meticulous and is usually easy, because the minimum length of the incision, about 1.5 cm, makes visualization of the fascia possible in nearly all cases. Continuous or interrupted sutures can be used, and reattachment of the umbilical stalk has been recommended. It is our recommendation to consider closing with a 1-0 delayed absorbable suture in a running "mass closure" fashion. In order to avoid infection and development of granulation tissue in the umbilical scar, antibiotic prophylaxis is proposed, and a thorough skin closure, avoiding inversion of skin edges, is recommended.

Training in a dry lab or enrolling in a training course is highly recommended in order to become familiar with the LESS technology. To work with and observe an experienced LESS surgeon is also very helpful when beginning to perform LESS surgery.

17.6 Status of LESS in Gynecology

In the last few years, several prospective studies have described LESS in adnexal surgery for benign pathologies, including unilateral or bilateral salpingo-oophorectomy, adhesiolysis, and excision of endometriosis. These investigations suggest good results in terms of safety, cosmetics, and postoperative pain. Ovarian cystectomy is, however, technically challenging due to difficulty in achieving the optimal traction-countertraction required for this procedure. These difficulties might be solved by using an additional 2 mm miniport.

LESS in total laparoscopic hysterectomy (TLH), supracervical hysterectomy (LSH), and laparoscopic-assisted vaginal hysterectomy (LAVH) have been described and demonstrated safe and feasible. Case-control studies in LAVH have shown improved blood loss, hospital stay, and pain scores (all $p<0.001$) in women who had LESS performed, compared to conventional multipuncture surgery. In total laparoscopic hysterectomy, suturing of the vaginal cuff can be a difficult and time-consuming task which may be eased by the use of a laparoscopic suturing device or a vaginal approach to close the cuff.

In gynecological oncology, a minimally invasive technique, resulting in the fastest possible recovery, is often essential in order to achieve more timely administration of adjuvant therapies. One center has published several reports demonstrating feasibility, safety, and reproducibility of the LESS approach for treatment of select early-stage endometrial or ovarian cancers and pelvic masses and for risk-reducing salpingo-oophorectomy (Fader and Escobar 2009; Fader et al. 2010).

More complicated procedures in gynecological oncology have been performed. Pelvic and

para-aortic lymphadenectomy have been demonstrated safe and feasible with comparable nodal counts to open or conventional laparoscopic surgery (Escobar et al. 2010a, b). In patients with truncal adiposity, reduced access to the left para-aortic nodal region has been experienced. One possible solution to this limitation is to position the patient in a lateral position with the left flank elevated in order to facilitate exposure of the left para-aortic lymph nodes, a technique used in urology when performing laparoscopic nephrectomy.

Learning curve and complications associated with LESS will be described in Chap. 20.

17.7 Indications for LESS

LESS generally improves the cosmetic benefits of minimally invasive surgery by providing only one incision and a relatively hidden umbilical scar. Further research will likely confirm the initial studies, reporting low complication rates, fast recovery times, less pain, and high patient satisfaction. Most studies have, however, been performed by experts in laparoscopic surgery. The routine application of LESS in gynecology not only requires evaluation of safety but also of cost-effectiveness since the use of single-use devices is high.

Conclusion

Minimally invasive surgery has become a standard of care for the treatment of many benign and malignant gynecological conditions. LESS represents the newest frontier in minimally invasive surgery. Comparative data and prospective trials are required in order to determine the clinical utility and impact of LESS in treatment of gynecological conditions. Future directions are associated with laparoendoscopic single-site surgery, including minimization of ports and instruments and the possibility of merging this technology with da Vinci robotic systems.

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