



Single-Port Laparoscopic Surgery for Endometrial Cancer: a Systematic Review

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Abstract

Purpose of Review This review aimed to provide an overview of single-port laparoscopic surgery and related literature. Based on previous reviews on endometrial cancer, we focused on the benefit of single-port laparoscopic surgery in endometrium cancer.

Recent Findings Endometrial cancer is the most common gynecological cancer and can be treated with laparoscopic surgery without negatively affecting the oncological outcome. Single-port laparoscopic surgery is a recently emerging endoscopic technique, and it was shown that endometrial cancer could be staged using this method.

Summary Research shows that endometrial staging with SILS is a feasible strategy that might become a common alternative to the conventional laparoscopic technique. In the future, this novel technique might take on a prominent role in advancing the evolution of minimally invasive gynecologic oncology surgery.

Keywords Laparoscopic surgery · Single-port laparoscopy · Endometrium cancer

Introduction

Endometrial cancer is one of the most frequently observed gynecologic cancers and lies tenth on the list of the most diagnosed cancers in women in the USA [1]. Unprotected estrogen exposure is a crucial element and consideration in endometrial hyperplasia and malignancy. The number of new endometrial hyperplasia and malignancy cases might be expected to rise dramatically in association with the ongoing increase in obesity. Possible medical procedures of endometrial cancer consist of total hysterectomy, bilateral salpingo-

oophorectomy (BSO), and pelvic and para-aortic lymphadenectomy [2]. Nonetheless, the necessity for lymphadenectomy remains controversial based on the large ASTEC study that reported that lymphadenectomy does not improve overall survival (OS) or recurrence-free survival (RFS) [3]. Nevertheless, the overwhelming number of patients in the ASTEC trial had grade 1 endometrial cancer, and the research that followed raised concerns about inadequate data to observe anomalies in survival rates for higher-grade endometrial cancer. Subsequently, surgical treatment is needed for endometrial cancer treatment [4].

Minimally invasive surgery (MIS) has become a mainstay in gynecology for benign and malignant indications. The primary function of MIS is to investigate alternatives that focus on improved quality of life for individuals, reduce perioperative morbidity, limit the need for lengthy hospitalization, and spend less time in recovery when measured retrospectively against laparotomy [5]. The Lap-2 study by the Gynecologic Oncology Group [6] revealed that the use of multiple-port laparoscopy in staging uterine cancer is safe and proactive, and results in a decline in surgical morbidity, and simultaneously enhances rates of disease-free survival (DFS) and OS compared with those of laparotomy [6]. As such, laparoscopic surgery is more appropriate than laparotomy for endometrial cancer.

In recent times, gynecologists have been inclined to carry out single-port laparoscopic surgery, also known as single-

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incision laparoscopic surgery (SILS), and laparoendoscopic single-site surgery, which allows a single incision—preferring the route through the umbilicus—to treat common gynecologic problems [7, 8].

Single-Port Laparoscopic Surgery

The primary objective of SILS is to reduce the necessity of skin incision while allowing access to the abdominal or pelvic cavity for performing surgical procedures. SILS is an unusual approach, further improving the cosmetic advantages of MIS and at the same time, negating the possibility of morbidity connected with numerous incisions. The technique has emerged as a novel approach for decreasing parietal trauma, surgical morbidity rate, postoperative pain, recovery period, and improving cosmetic results (scarless abdominal surgery) [9, 10]. This innovative technique exposes some thought-provoking considerations, including a dramatic decline of depth perception, instrument crowding, and possession of laparoscopic skills.

The usage of this novel technique in gynecologic oncology was first reported in 2009 by Fader et al. [9]. Subsequently, a growing body of data shows that SILS is a safe and effective minimally invasive treatment for gynecologic malignancies [11]. Nonetheless, SILS is not a new concept in gynecologic surgery. In 1970, Wheelless [12] conducted a study of 3600 women that participated in inexpensive, rapid, and effective tubal ligation (sterilization) via single-trocar laparoscopy. Notwithstanding, laparoscopic hysterectomy was first described in the early 1990s. The 4-trochar laparoscopic technique is the most preferred and widely used option for extra facial hysterectomy in cases of early-stage endometrial cancer [13]. However, pioneering efforts into single-port laparoscopy have not evolved into a broadly used surgical approach in gynecologic surgery. Controversially, following the turn of the millennium, technology has been evolving at astonishing rates, and the medical world has been both eager and able to neutralize some of the restrictions presented by the single-port technique.

Surgical Technique

After completely everting the umbilicus, a single 2-cm cutaneous incision is made over the lower rim of the umbilicus, down to the level of the fascia. The abdominal cavity is then entered directly (Fig. 1). After abdominal entry, using a traumatic clamp, the single-port laparoscopy (SILS™ Covidien, Hampshire, UK) is grasped just above the lower rim after lubricating it by immersion in a sterile solution (e.g., saline or water). The SILS™ Covidien is used with three trocars: 1 for the 10 mm 30° camera and the other 2 for the laparoscopic instruments (Fig. 2). There is also a myriad of single-port



Fig. 1 The initial incision and entrance to the abdominal cavity

laparoscopic devices utilized for gynecological oncological surgery, such as GelPOINT® (Applied Medical, Rancho Santa Margarita, CA) and X-CONE (Karl Storz, Tuttlingen, Germany) (Fig. 3). Single-port laparoscopic hysterectomy is performed, and then, the retroperitoneum is dissected so as to identify the main structures. Finally, pelvic lymphadenectomy is performed (Fig. 4).

Single-Port Laparoscopic Surgery for Endometrium Cancer

Laparoscopic surgery for the treatment of gynecological cancers is now built of firm foundations and further advancements in the future are widely anticipated. The inception of SILS finds its routes in Escobar and Fader's [9] 2009 publication of the first series of patients to undergo single-port surgery for gynecologic malignancies, which included data for 13 women. Their study showed that the novel technique was effective, resulting in significantly reduced postoperative abnormalities, using only a single incision. Similarly, Fader et al. [14] reported that the average duration to carry out the Hasson open umbilical incision and single-port insertion was 9.2 min for cases 1–10, 4.98 min for cases 11–20, and 4.3 min for cases 21–31 ($P < 0.0001$) [14]. These initial results suggested that the resulting data for conventional laparoscopy and single-port laparoscopy yielded similar returns.

Data on the surgical outcome of SILS in gynecologic oncology continue to increase [15]. The literature includes numerous findings regarding the SILS approach for endometrial cancer. The most extensive study on SILS for staging endometrial cancer shows that it is safe, effective, and practical and that it may present an appropriate surgical modality for complicated oncology procedures [16]. Nonetheless, that study included a non-consecutive effect and under 50% of the cases had systematic lymphadenectomy; therefore, there remains

Fig. 2 Port placement



the need to more fully evaluate the consequences of the full staging of uterine cancer when hysterectomy and pelvic and para-aortic lymphadenectomy are consecutively performed in all cases.

Pelvic and para-aortic lymphadenectomy is a fundamental procedure in gynecologic oncology. Transumbilical transperitoneal laparoscopic lymphadenectomy continues to be the most practiced procedures when carrying out minimally invasive techniques among gynecologic oncologists. The method is predominantly the same for both traditional laparoscopy and robotic surgery. Nevertheless, there are some alterations in port placement that are contingent upon the level of aortic dissection. In this regard, Escobar et al. [17] reported the effectiveness of SILS pelvic and para-aortic lymph node dissection in patients with gynecologic malignancies (cervical, endometrial, and ovarian). Their study included 21 patients, and the median overall duration of surgery was 120 min (range, 60–120 min), and median pelvic and para-aortic lymph node counts were 14 (range, 1–7) and 6 (range,

2–14), respectively. They reported that the technique was effective and was not associated with morbidity, concluding that SILS has demonstrated definite conclusions without the need for the saline placement of additional ports or conversion to laparoscopy in cases of early-stage endometrial cancer.

Several studies have examined the consequence of executing SILS in patients with early-stage endometrial cancer (Table 1). Fanfani et al. [18] used SILS to perform laparoscopic hysterectomy in 20 endometrial cancer patients, observing that surgical duration was similar to that of conventional laparoscopy. Concurrently, a multicentric retrospective study by Fagoti et al. [16] included 100 participants that underwent hysterectomy and BSO, of which 48 and 27 underwent pelvic and para-aortic lymph node dissection, respectively, was published. They reported that the mean blood loss and the median duration of surgery were comparable with those of multiport laparoscopy. Another study compared outcomes in more than 37 consecutive patients that underwent SILS staging of endometrial cancer and 74 sequential patients that took part in 4–

Fig. 3 A. GelPOINT® (Applied Medical, Rancho Santa Margarita, CA) and B. X-CONE (Karl Storz, Tuttlingen, Germany)

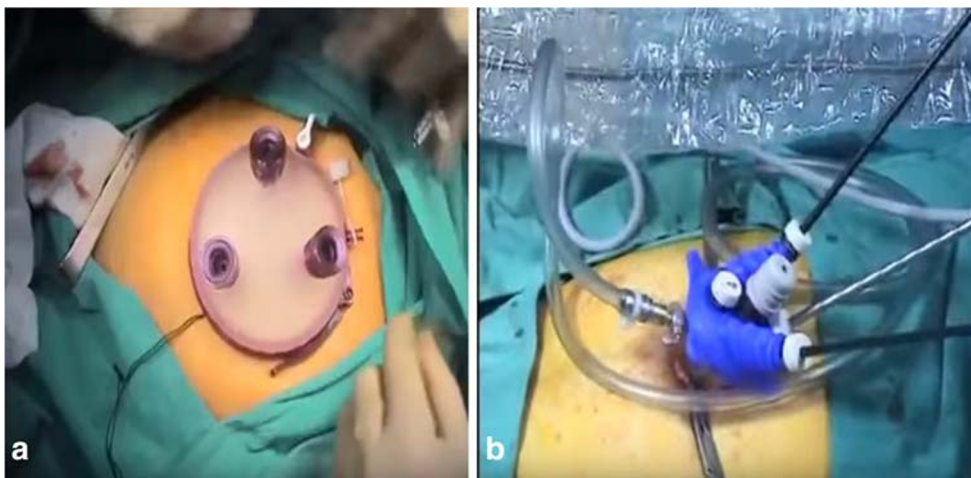


Fig. 4 Single-port laparoscopic hysterectomy and pelvic lymphadenectomy are performed



port laparoscopic staging. This case-control series showed that there was not a significant difference in estimated blood loss, complications, lymph node retrieval, or surgical duration between the two groups [19]. A retrospective review of 102 patients that underwent SILS for benign and malignant conditions reported adversely low rates of surgical site infection, intraoperative injury, blood transfusion, and readmission [20••]. Similarly, Gunderson et al. reported an umbilical cellulitis rate of 5.2% [21].

SILS for the Sentinel Lymph Node

Sentinel lymph node (SLN) mapping has recently surfaced as an optional procedure to lymphatic evaluation, which positively impacts perioperative results in patients with endometrial cancer. A recent meta-analysis of 26 studies reported that SLN biopsy had an endometrial cancer detection rate of 78%, with a sensitivity of 93% [22]. By focusing on the initiate lymph nodes that drain the uterus, surgeons can improve the detection rate of lymphatic metastasis, lessen the risk of lymphedema associated with full lymphadenectomy, and reduce the duration of surgery [23]. Nonetheless, the literature includes few data on SLN surgery in patients undergoing surgical staging of endometrial cancer.

What Are the Drawbacks of SILS?

Insertion of the endoscope and surgical instruments through a single incision leads to internal and external conflicts between both the instruments and the surgeon's hands. Parallel placement of surgical instruments reduces flexibility and restricts the movement due to the close proximity of the hand and

surgical tools, which is referred to as “sword fighting.” Moreover, crossing the instruments to improve variations of the movement requires a cross-hand technique, which makes surgical maneuvers less fluid and more complicated. Utilizing articulated or curved instruments and flexible scopes of multiple dimensions and lengths decreases the incidence of the above-mentioned problems but do not entirely eliminate them.

Another point to consider is that there are some concerns regarding the ability to reproduce the SILS technique, advancements in single-port surgery, and the practicality of the technique for radical hysterectomy and pelvic and para-aortic lymphadenectomy in patients with advanced-stage endometrial cancer. From a total of 20–40 patients, the learning curve of the surgeon led to an adjustment in procedural technique [24•]. This adaptation period is evident in a myriad of documented literature regarding the adaptation of any laparoscopic surgical technique. As surgeon comfort and experience improved, there was a significant decrease in the duration of surgery, estimated blood loss, surgical complications, and hospital readmission [24, 25]. Barnes et al. [26] observed a dramatic decline in the duration of SILS after approximately the first 20 cases.

Only limited data is accessible related to short-term negative results and the long-term possibility of hernia associated with SILS in gynecologic oncology patients. Jennings et al. [20••] reported an incisional hernia rate of 1.8% within 30 days of surgery, but limited data concerning the risk > 3 days postsurgery in endometrial cancer patients that underwent SILS. Similarly, Moulton et al. [27•] observed an incisional hernia rate of 5.5% that increased to 23.0% 3 years postsurgery in high-risk endometrial cancer patients that underwent SILS.

Conversion from laparoscopy to laparotomy may be necessary to complete a staging procedure or prevent irreversible

Table 1 Summary of studies on single-port laparoscopic surgery for endometrial cancers

First author, publication year (study period)	No. of patients (SILS-endometrium cancer)	Mean duration of surgery (min)	Estimated blood loss (mL)	Conversion to laparotomy	Number of pelvic/para-aortic lymph nodes	Intraoperative complications	Postoperative complications	Length of hospitalization (d)
Barnes H., 2017 (2012–2015)	115	186	242	7	30/30	2 IVC, 1 bowel injury	2 ventral hernia formation	1.3
Fagotti A., 2013 (2011–2013)	38	107	30	0	UN	0	0	UN
Zapardiel I., 2015 (2015)	4	263	UN	0	11.5/22	0	0	3.5
Escobar PF., 2012 (2009–2010)	30	155	100	1	15/11	1 vascular injury	UN	1.2
Rossitto C., 2017 (2013–2016)	25	120	30	0	UN	1 bladder injury	0	1
Park JY., 2014 (UN)	37	183	194	0	24.6/4.9	1 bladder injury	0	5
Fanfani F., 2011	72	105	20	0	UN	0	0	1

IVC inferior vena cava; UN unknown

damage. The conversion rate is directly connected to rates, metastatic disease, patient age, and BMI. The leading cause of conversion is inadequate visualization due to the inability to maintain the Trendelenburg position. Furthermore, anatomical difficulties, such as a large uterus that is difficult to remove via the vaginal canal, dense adhesion, and intraoperative complications, can result in the need for conversion. The conversion rate is associated with widespread metastatic disease, patient age, and BMI.

Conclusion

Research shows that the SILS technique is a risk-free and effective approach for full surgical staging of early-stage endometrial cancer. Endometrial staging with SILS is a feasible strategy that might become a common alternative to the conventional laparoscopic technique; however, more data are required concerning the SILS learning curve as well the long-term clinical benefits. Nonetheless, the role of this novel MIS approach in gynecologic oncology remains to be widely adopted. At present, research and development of single-port robotics are continuing. This novel technique might play a fundamentally important role in the reproducibility and spread of SILS, taking on a prominent role in advancing the development of minimally invasive gynecologic oncology surgery.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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- Of major importance

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