REVIEW ARTICLE

Recent Advances in Laparoscopic Hysterectomy: Journey from Multiple Incision to Single Incision Hysterectomy

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Abstract

Four different approaches for hysterectomy are possible: through laparotomy; via the vagina; with the help of laparoscopy using several small incisions; and by single incision laparoscopic surgery. Currently, around 70 to 90% of hysterectomies are carried out via abdominal incision. This article compares the outcome of LAVH with SILS. In the SILS hysterectomy, only a single small incision in the belly button is created for insertion of the surgical instruments. The entire hysterectomy is performed using the SILS Port allows for the removal of the uterus through a small incision which measures only 20 mm. Compare to laparoscopic assisted vaginal hysterectomy recovery from the SILS hysterectomy is similar to the 2 weeks; however, laparoscopic hysterectomies may require multiple incisions which has less cosmetic value. Technological advances in SILS, including those in port structure, will enable gynecologists in future to employ strategies that effectively enhance instrument coordination and suturing. However; benefits of SILS to the patient need to be further documented prospectively before it can be recommended widely for every gynecologist to perform.

Keywords: Single incision laparoscopic surgery (SILS), laparoscopic assisted vaginal hysterectomy (LAVH), operative outcome in LH, pain, operative time in TLH, length of stay after hysterectomy.

INTRODUCTION

The benefits of surgical treatment of disease have always been viewed as being obtained with a certain acceptable level of pain and trauma to the patient. Minimizing this untoward effect of any surgical procedure has been a driving force of laparoscopy since its inception in the early 1900s.[1,2] Even with the clear benefits of laparoscopy over open surgery,[3] we have continued to see a trend toward fewer invasions in the quest for "scarless" surgery.

Laparoscopic assisted vaginal hysterectomy (LAVH) was first performed by Reich in the year 1989. It has been implemented in hysterectomy procedures for uterine myomas and adenomyomas. Three or four laparoscopic ports are traditionally required to complete a LAVH. One port is inserted through the infraumbilical, and the other ports are usually inserted through the lateral abdominal wall muscles, suprapubis, or both.[4] To minimize minimally invasive surgical techniques such as LAVH, single-port-access (SPA) laparoscopic surgery has been developed.[5-7]

SILS AN EMERGING ALTERNATIVE FOR HYSTERECTOMY

SILS was first performed for the treatment of appendicitis at Department of Pediatric Surgery, Dokuz Eylul Medical School, Izmir, Turkey and first presented at—The Annual Congress of Turkish Association of Paediatric Surgeons, October 2005. SILS has the advantage of improved cosmesis, ease of tissue retrieval, increased patient acceptance (Figs 1 and 2). Whether it causes less pain or early recovery needs further trials.

Single incision laparoscopic surgery (SILS) refers to performing laparoscopy through a single incision. This approach is also referred to as single access surgery (SAS), single port surgery (SPS), single port access (SPA), single port laparoscopy (SPL) and one port umbilical surgery (OPUS).

SILS has several other advantages compared with conventional multiple incision laparoscopic hysterectomy. First, operative complications related to trocar insertion such as epigastric vessel injury, operative wound infection, and hematoma and visceral organ damage might be avoided by reducing the number of ancillary ports penetrating abdominal wall. In particular, bleeding from epigastric vessels is one of the major complications after laparoscopic surgery.

Inferior epigastric vessels course cephalad from the external iliac vessels in the lateral third of the rectus abdominis. Injury of these vessels occurs, when the ancillary trocars were inserted through the lower quadrant

Fig. 1: Scarless SILS

Fig. 2: Scar of LAVH

of abdominal wall. For the purpose of preventing this injury, several methods have been recommended, such as identifying vessels before trocar insertion using transillumination, trocar insertion in areas with low-risk of vessel injury, and direct visual examination of the trocar insertion sites after trocar removal.[8,9] In SPLS, an ancillary port does not need to be placed on the abdomen. Therefore, epigastric vessel injury might be reduced. Second, the single-port approach through the umbilicus might offer better cosmetic results in our subjective opinion.

A 1.2 cm vertical intraumbilical skin incision caused little scarring. Third, using SPLS seems to reduce the postoperative pain that results from skin incisions and penetrating muscles and fascia with assistant trocars.

CHALLENGES OF SILS

It must be remembered that with in-line viewing, a move of the camera often results in an inadvertent move of an adjacent instrument. This can increase difficulty in performing relatively simple tasks that require looking at two sides of a structure. Put simply, the multiple instruments and laparoscopes required for a procedure are competing for the same space at the fulcrum of the entry port, causing hand collisions externally and difficulty with instrument tip manipulation internally. Instruments of differing lengths can ameliorate some of this, but some learning on the part of the surgeon still is required.

The major disadvantage of the single-port surgery is limitation of movement due to the proximity of the instruments to each other during operation. Suturing the vaginal cuff laparoscopically using a single-port is especially complex due to the clashing of instruments.

AIMS

The aim of this study was to compare between multiple incision and single incision laparoscopic hysterectomy. The following parameters were evaluated for both multiple incision and single incision laparoscopic hysterectomy.

- Method of patient selection
- Operative technique
- Operating time
- Intraoperative and postoperative complications
- Postoperative pain
- Postoperative recovery
- Cost-effectiveness
- Learning curve
- QOL analysis
- Patient acceptance.

MATERIALS AND METHODS

A literature review was performed using Springer link, Highwire Press, BMJ, Journal of MAS and major general search engines like Google, MSN, and Yahoo, etc. The search terms were used for multiple incisions and single incision laparoscopic hysterectomy. Citations found in selected papers were screened for further references. Criteria for selection of literature were the number of cases (excluded if less than 20), methods of analysis (statistical or non-statistical), operative procedure (only universally accepted procedures were selected) and the institution where the study was done (specialized institution for laparoscopy were given more preference).

EQUIPMENT FOR SILS

The specialized instruments used in SILS are available with following configuration:

- SILS device from Covidien
- Gel Point system from applied medical
- R-Port and TriPort from advanced surgical concepts
- Uni-X from Pnavel.

Hand Instruments for SILS comes in Two Configurations

- Standard laparoscopic instruments
- Articulating instruments.

DIFFERENCE IN SILS OPERATIVE TECHNIQUE

The operative procedures were not different between the two groups with the exception of port placement. For multiple incision laparoscopy three ports (one 12 mm trocar in the infraumbilicus and two 5 mm trocars in lateral abdominal walls) were used. The patient was placed in the dorsal lithotomy position. A uterine manipulator was inserted to effectively make a surgical field. A 2.0 cm vertical or Ω shaped incision was made within the umbilicus (Fig. 3).

A small wound retractor was inserted into the wound opening transumbilically (Figs 4A and B).

Once the wound retractor was fixed in the opening site, it laterally retracted the sides of the wound opening, thus making the small incision into a wider, rounder opening.

A 5 mm rigid laparoscope and an articulating instrument (Roticulator, Covidien, Norwalk, CT, USA) to avoid clashing of the instruments and to optimize the range of motion (Figs 5 to 9).

Fig. 3: SILS incision line

The ovarian ligaments, round ligament, and broad ligament were dissected (Fig. 10).

The adnexal structure and ligaments were dissected bilaterally.

The vaginal approach was started and at the end SILS port wound should be closed (Fig. 11).

POSTOPERATIVE MANAGEMENT

In most of the studies, patients were permitted sips of water starting 6 hours after surgery. A clear liquid diet was offered as the first meal after passing flatus. The next meal was a soft diet and then patients were offered a general diet. If pain control was needed, 30 mg ketorolac was administered intravenously. Intravenous catheters were removed when patients could tolerate a general diet. Urinary Foley catheters were removed on the morning of postoperative day 1 and patients were encouraged for that.

Fig. 4A: Access technique

Fig. 4B: 22 mm incision

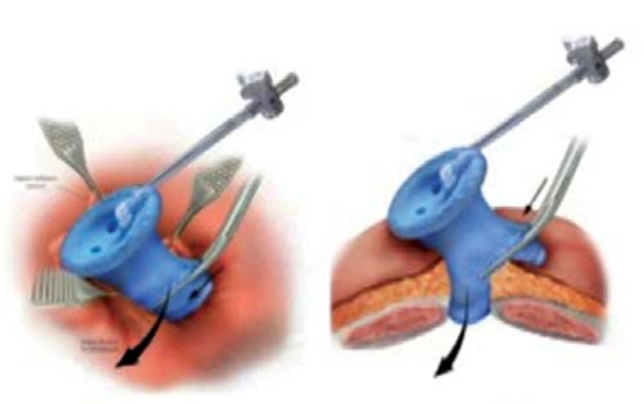

Fig. 5: SILS port

Fig. 8: Manipulation angle maintained

Fig. 6: Introduction of SILS port

Fig. 9: Introduction of instruments

Fig. 7: Port placement

Fig. 10: Dissection of round ligament

Fig. 11: Closure of skin incision

POSTOPERATIVE PAIN

It is proved that single incision laparoscopic procedures cause less or same postoperative pain than their conventional counterparts. In this study, none of the literature reviewed found which can describe pain score comparison between SILS and after laparoscopic procedure.

POSTOPERATIVE RECOVERY AFTER SILS

It was seen that the postoperative recovery was similar in SILS and multiple incision hysterectomy. Although, SILS is newer procedure and the number of SILS hysterectomy performed by most of the gynecologists are less compare to multiple incision so further study is require to draw any conclusion in this regard.

SILS AND PORT WOUND INFECTION

The risk of wound infection is more in SILS compared to the multiple incision procedure it should be cautioned that the definition of wound infection varies between studies. The reason of more port wound infection is bigger defect in abdominal wall and due to open technique of entry more chances of hematoma and necrosis. Some studies have shown increased incidence of postoperative intra-abdominal abscess after SILS as compared to and multiple incision hysterectomy. It could be due to difficulty in localizing the hematoma site after SILS.

SILS IN COMPLICATED CASES OF HYSTERECTOMY

Due to the risk of intra-abdominal abscess formation there is a strong controversy among gynecologists regarding the use of the laparoscopic procedure in complicated cases like complicated broad ligament or posterior cervical myoma, endometrioma, multiple previous laparoscopy, huge uterus, etc.

OPERATING TIME AND SILS

In almost all the literature, the operating time of SILS were found to be more than that of multiple incision laparoscopic hysterectomy. The difference in mean operating time ranged from 100 minutes (57-155 minutes) in SILS compare to 30 to 90 minutes in multiple incision. The operating time also depends on the experience of the surgeon and the competence of their team.[20]

In considering operating time, the exact identification of the timing of the start of the procedure and its conclusion vary. In general, the time should be calculated from the insertion of first trocar to the end of skin suturing. Cox et al defined operating time as the time from incision to wound closure.[10] Tate et al calculated the time as use of anesthesia to the administration of a reversal agent.[11]

Generally, SILS is more time-consuming for the following reasons:

- Triangulation of the instruments
- Time taken due to lack of expertise.

VARIATION IN POSTOPERATIVE IMMUNITY LEVEL

All surgery and anesthesia can cause depression of cell-mediated immunity in the postoperative period, including reduction in the number of circulating lymphocytes, impairment of natural killer cell cytotoxicity, depression of T-cell proliferation, and diminished neutrophil function. Animal and clinical studies have shown that laparoscopic surgery impairs a patient's immune state less than open surgery. Cell-mediated immunity is less impaired after multiple incision laparoscopic hysterectomy than after single incision laparoscopic hysterectomy. The reason is probably the level of Interleukin 6 after SILS is more than that after multiple incision laparoscopy surgery.[12]

COST-EFFECTIVENESS OF SILS

SILS is costlier than multiple incision laparoscopic hysterectomy as the port is costlier and the surgeon has to use the disposable instrument made by standard companies.

DISCUSSION

SILS has gained lot of attention around the world. Several controlled trials have been conducted; some are in favor of SILS. The goal of this review was to ascertain that if the SILS is superior to multiple incisions, and if so what are the benefits and how it could be instituted more widely. There is also diversity in the quality of the randomized controlled trials. The main variable in these trials are following parameters:

- Number of patients in trial
- Withdrawal of cases
- Exclusion of cases
- Blinding
- Intention to treat analysis
- Publication biases
- Local practice variation
- Prophylaxis antibiotic used
- Follow-up failure.

Without proper attention to the detail of all the parameters it is very difficult to draw a conclusion. It has been found among the gynecologist that there is a hidden competition between the gynecologist performing SILS and the surgeons who are still doing multiple incision surgery, and this competition influences the result of study. One should always think of SILS and multiple incision laparoscopic hysterectomy as being complimentary to each other.

A successful outcome requires greater skills from the operator. The result of many comparative studies have shown that outcome of SILS was influenced by the experience and technique of the operator. SILS requires different skills and technological knowledge. Gynecologist should perform the procedure with which they are more comfortable.

In a study, done by Tae-Joong Kim et al, a retrospective case-control study comparing 43 SPA-LAVHs (cases) and 43 conventional LAVHs (controls). SPA was associated with reduced postoperative pain. VAS-based pain scores 24 hours (SPA, 2.5 ± 0.7; conventional, 3.5 ± 0.8; p\0.01) and 36 hours (SPA, 1.7 ± 1.2; conventional, 2.9 ± 1.1; p\0.01) after surgery were lower for the SPA group. However, the pain scores 12 hours after surgeries were not different between the groups. They concluded that SPA-LAVH has comparable operative outcomes to conventional LAVH and the postoperative pain was decreased significantly in the SPA group 24 and 36 hours after surgery. The results of this study show that the operative outcomes, including operative time, hospital stay, and EBL, in the SPA-LAVH group were comparable to those of the conventional LAVH group. In addition, pain after surgery was lower in the SPA group than in the conventional group. The SPA technique has been improved and might be adequate for gynecologic surgery.[13-16]

In another study, Takahiro Koyanagi et al compared outcomes of single-incision LAVH *vs* conventional multiport LAVH. The mean operative time was 76 ± 15.5 *vs* 71.4 ± 21.7 min (P = 0.57).[17] The mean weight of resected uterus was 366.3 ± 144 *vs* 354 ± 95.5 gm (P = 0.85). BMI was 23.3 ± 2.75 *vs* 22.2 ± 3.76 kg/m^2 (P = 0.52). No significant difference was observed between single-incision and conventional LAVH. They concluded that single-incision LAVH can be undertaken safely and with similar operative results to conventional multiport LAVH. They considered it a promising alternative method for the treatment of some patients with uterine myomas as incision-free gynecological operation.

Erica R Podolsky et al went for a 24 months follow-up of novel laparoscopic approach utilizing standard instrumentation.[18] They demonstrated that SPA surgery is an alternative to multiport procedures with proposed initial benefits of decreased number of incisions and improved cosmesis for the patient. Long-term prospective randomized large case series will be necessary to assess pain, recovery, and hernia formation proving advantages, if any, over multiport laparoscopy. Another retrospective study showed an improved pain benefit.[19]

The results of the study of Yong Wook Jung et al revealed that for SILS median operative time was 100 min (57-155 min), median blood loss was 100 ml (10-400 ml), median postoperative hospital stay was 3 days (2-6 days), and there were no operative complications including transfusion.[20] VAS scoring of operative pain at 6, 24, and 48 hours after surgery was 4, 3, and 2, respectively. Although there was a case that required a conversion to two-port TLH, they performed 29 cases of hysterectomy without any operative complications using the single-port approach. In terms of surgical outcomes and operative complications including pain scores, their data were comparable to those of other investigators who evaluated the feasibility of TLH using three or four ports.

General Comparison between SILS Hysterectomy and LAVH

	Number of external incisions	*Size of external incisions*	*Number of visible scars*	*Length of hospital stay*	*Recovery time*
SILS™ hysterectomy	*1 small incision (incision in the belly button)*	*About 3/4 inch (slightly smaller then the diameter of a nickel)*	*Potential for no visible scars*	*Same day*	*2 weeks*
Abdominal (open) hysterectomy	1 large incision	5 to 7 inches	1 large scar	1 to 2 days sometimes 4 days	6 to 8 weeks
Laparoscopic hysterectomy	3 to 4 small incisions	From 1/4 to about 3/4 inch	3 to 4 small scars	same day	2 weeks
Vaginal hysterectomy/ Laparoscopically assisted vaginal hysterectomy (LAVH)	0 to 4 incision	0 to 3/4 inch	0 to 4 scars	1 to 3 days	3 to 4 weeks

Future Prospects of SILS

In the future, SILS will overcome some of the manipulative restriction of current instruments. But the future of any new technology depends upon its acceptance by patient and surgeon. Its ease of application and training may show the acceptance and some long-term randomized control trials are awaited to draw any conclusion.[21]

CONCLUSION

The concept of performing laparoscopic surgery via a single incision regardless of the technique is gaining traction rapidly among patients, surgeons, industry, and investors. It is likely that the public will demand this even less invasive surgical approach much in the same way that it forced the explosion of laparoscopic surgery two decades ago. Days are coming, so that more technological improvement in articulating instruments of SILS for better ergonomics will be there. And there is no doubt that 5 years from now SILS will emerge as method of choice for laparoscopic hysterectomy. In our review, it has been found that SILS is becoming an effective alternative to LAVH but further studies are required to confirm its efficacy.

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