Single-port versus conventional multi-port access laparoscopy assisted vaginal hysterectomy: A comparison of surgical outcomes and complications

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Abstract

Objective: To evaluate surgical outcomes and complications between single-port access(SPA) and multi-port access(MPA) laparoscopy assisted vaginal hysterectomy(LAVH).

Study design: A retrospective review of medical records was performed in patients who underwent LAVH at Eun Hospital between April 2010 and April 2012 for non-malignant gynecological diseases.

120 women underwent SPA-LAVH using transumbilical homemade three-channel single-port system (SPA-LAVH group) and 130 women underwent conventional multi-port system (MPA-LAVH group).

We analyzed the data to compare the surgical outcomes and complications in SPA-LAVH and MPA-LAVH groups.

Results: The comparative outcomes of SPA-LAVH vs. MPA-LAVH were as follows: the mean ± SD of total operative time (73.1 ± 24.3 vs. 70.3 ± 22.1 min, $P = 0.349$), largest dimension of uterus (10.7±2.3 vs. 10.8±2.8 cm, $P = 0.847$), weight of extirpated uterus (311 ± 185 vs. 339 ± 234 g, $P = 0.298$), and hemoglobin change (1.7 ± 0.8 vs. 2.0 ± 0.9 g/dL, $P = 0.025$).

The incidence of complications were similar in each group (20 vs. 16 patients, $P=0.327$).

Unintended intraoperative laparotomy was not necessary in both the groups.

Neither bowel injury nor great vessel injury occurred in the two groups. The bladder of three patients (one patient of the SPA-LAVH group vs. two patients of the MPA-LAVH group) was injured.

The postoperative course was uneventful in most of the patients, but four vs. two patients had a transient paralytic ileus and five vs. five had pelvic hematoma, who recovered following conservative managements.

Port-related complications were rare, except for one patient who had port-site umbilical hernia in the SPA-LAVH group.

Introduction

One of the great innovations in the history of surgery is the shift from laparotomy to operative laparoscopy. However, the efforts and advancements have been continuing without stop in minimal invasive surgery. To optimize the benefits of minimal invasive surgery, surgeons have attempted to reduce the overall abdominal wall incision by decreasing the size and number of ports.

Thus, another innovative single-port operative laparoscopic surgery was born.

This technique appears to be novel, but the single-incision approach to gynecological diseases is not a new idea.

Historically, laparoscopy originated as a single-access technique first for the diagnostic procedures only and, subsequently, for minor surgeries.

Wheeless and Thompson, in 1969, first published the technique and the results of a large series of laparoscopic tubal ligation with single-trocar laparoscopy, while in 1991, Pelosi and Pelosi reported total abdominal hysterectomy with bilateral salpingooophorectomy (BSO) using only a single incision [1-4].

Transumbilical single-port surgery enhances cosmetic benefits because the surgical incision is hidden in the umbilicus and reduces postoperative pain [5-8].

Despite the benefits, single-incision operative laparoscopy did not spread rapidly due to technical difficulties.

However, surgical skills and instruments have been greatly advanced and surgeons have jumped over the hurdles for single-port laparoscopy considerably [9-12].

In this study, we present our surgical outcomes and complications of single-port access laparoscopy-assisted vaginal hysterectomy (SPA-LAVH) vs. conventional multi-port LAVH (MPA-LAVH).

Materials and Methods

1. Statistical analysis

A review of retrospective medical records was performed in patients who underwent laparoscopy-assisted vaginal hysterectomy for benign gynecological diseases at Eun Hospital between April 2010 and April 2012.

The study limited to benign gynecological disease on pathologic reports, because essential outcomes of malignant diseases should be determined by the specific parameters such as recurrence and survival rate.

So malignant diseases were excluded equally in both SPA and conventional MPA-LAVH group, eventually total of 250 women were enrolled in this study.

During the study period, 120 women underwent SPA-LAVH using transumbilical homemade three-channel single-port system (SPA-LAVH group) and 130 women underwent conventional multi-port LAVH (MPA-LAVH group) by six surgeons.

Surgical techniques were choosed by surgeon's skill, preference and clinical situations.

We analyzed and compared the data to determine the surgical outcomes and complications in SPA-LAVH and conventional MPA-LAVH groups.

Past abdominopelvic surgery, body mass index (BMI), and the size of uterus were not considered as exclusion criteria.

The following parameters of both the groups (SPA-LAVH vs. MPA-LAVH group) were determined in the study: age, parity, body mass index (BMI), abdominopelvic surgical history, indication for surgery (as pathology report), total operative time (from incision to final umbilical closure), the largest dimension of the uterus (as preoperative ultrasonography measurements), the weight of the extirpated uterus (as the pathology reports), hemoglobin change (from before surgery to postoperative Day 1), and perioperative and postoperative complications.

Differences in the proportions of categorical variables were evaluated using ***chi-square or Fisher's exact test*** when the expected cell values were lower than 5. The ***student's t-test*** was used to analyze the differences in the mean of continuous variables between the groups.

2. Operative procedures

Operative techniques were similar in both the groups (SPA-LAVH vs. MPA-LAVH group), except for port number, trocar placement points, and induction of pneumoperitoneum.

Uterine manipulator was applied in both the groups through vagina.

All surgical procedures were similar to standard LAVH (with or without BSO) technique using conventional nonarticulated rigid laparoscopic instruments and the LigaSure™ system (Valleylab, Boulder, CO, USA).

In our series, ligation of uterine vessel, cardinal and uterosacral ligament, extirpation of uterus, and vaginal stump closure were performed through vagina.

(1) SPA-LAVH

As described earlier, we used homemade, three-channel single-port system using the Alexis® wound retractor (Applied Medical, Rancho Santa Margarita, CA, USA), surgical glove, two 10-mm trocars, and one 5-mm trocar.

After partial eversion of umbilicus, a curved C-shaped skin incision was performed at the lateral surface of the umbilical crater. Subsequently, a rectus fasciotomy and peritoneal incision were performed by direct cut-down technique.

The fascial edges were tagged with suture for traction prior to port-system installation; this was useful for fascial closure at the end of the procedure.

The distal ring of Alexis® wound retractor was loaded within the intraperitoneal space and tightly turned inside out of the proximal ring.

Once fixed in the opening site, the connecting sleeve of Alexis® wound retractor was used to laterally retract the sides of the opening. This made the small incision become a wider and rounder opening, and formed an air-tight seal.

Subsequently, a sterile surgical glove was placed over the proximal ring and fixed, and three trocars were inserted through the surgical glove with cut edges of the distal fingertips and tied with an elastic string.

After installation of the three-channel single-port system, carbon dioxide pneumoperitoneum was achieved through single-port system directly.

2) MPA-LAVH

After partial eversion of the umbilicus, a curved transverse skin incision was made at the inferior surface of the umbilical crater near the base.

After carbon dioxide pneumoperitoneum was

achieved through a Verres needle, a 10-mm trocar was placed through umbilicus and the camera was inserted. Further, two 5-mm trocars were placed at left iliac and lumbar region.
Accessory right and suprapubic trocar were not necessary.

Results

Table 1 shows the demographic characteristics of the patients, including previous abdominopelvic surgery history and the pathologic diagnosis of uterus after hysterectomy.
Comparative demographic data of SPA-LAVH vs. conventional MPA-LAVH were as follows: the mean ± standard deviation (SD) of patients' age (48.9±5.7 vs. 48.6±6.5 years, P=0.760), BMI (24.6±2.9 vs. 23.5±2.5 kg/m^2, p=0.001), and parity (2.3±0.9 vs. 2.4±1.0, P=0.599).
Furthermore, 34 vs. 29 patients(P=0.273) had previous abdominopelvic surgery history.
There were no differences between the groups with regard to the patients' demographic characteristics.
As shown in Table 2, the comparative outcomes of SPA-LAVH vs. conventional MPA-LAVH were as follows: the mean± SD of total operative time (73.1 ± 24.3 vs. 70.3 ± 22.1 min, *P* = 0.349), largest dimension of uterus (as preoperative ultrasonography measurement, 10.7±2.3 vs. 10.8±2.8 cm, *P* = 0.847), weight of extirpated uterus (as pathology reports, 311 ± 185 vs. 339 ± 234 g, *P* = 0.298), and hemoglobin change (from before surgery to postoperative Day 1, 1.7 ± 0.8 vs. 2.0 ± 0.9 g/dL, *P* = 0.025).
There was no difference in the operative data between the two groups, but the total operative time needed was greater in the SPA-LAVH group, which maybe due to single-port system installation time.
As shown in Table 2, The incidence of complications were similar in each group (20 vs. 16 patients, *P*=0.327).
Unintended intraoperative laparotomy was not necessary in both the groups and extra-umbilical puncture or conversion to conventional multi-port laparoscopy was not required in the SPA-LAVH group.
Neither bowel injury nor great vessel injury occurred in the two groups. The bladder of three patients (one patient of the SPA-LAVH group and two patients of the MPA-LAVH group) was injured during operation, but it was treated through intraoperative laparoscopic suture and Foley catheter was maintained for 1–2 weeks, and the patients completely recovered.
In the MPA-LAVH group, one patient's ureter was injured, but was treated intraoperative laparoscopically and double-J catheter was maintained for 3 weeks.
Furthermore, 2–3-unit transfusion of packed red cells was needed in nine vs. seven patients (SPA-LAVH vs. MPA-LAVH group) due to chronic anemia and intraoperative hemorrhage, respectively.
The postoperative course was uneventful in most of the patients, but four vs. two patients had a transient paralytic ileus and five vs. five had pelvic hematoma, who recovered following conservative managements.
Port-related complications were rare, except for one patient who had port-site umbilical hernia 1 week postoperatively and some port-site hematoma; however, external drainage was not needed in the SPA-LAVH group.

Comments

LAVH seems to be the most ideal for single-port surgery because the vagina of woman can be considered as an additional route for surgery and uterine manipulators can be applied through the vagina. Unlike uterine repair after myomectomy, reconstructive procedure through laparoscopy can be skipped in LAVH. This is because the vaginal stump can be repaired not by laparoscopy, but also through the vagina.
Thus, skillful surgeons can learn SPA-LAVH over a short period of time, because considerable portion of the procedure can be performed through the vagina [13-18].
This homemade single-port system has several functions and advantages.
It can be easily converted to a multi-port access procedure if necessary. Also, the wound retractor prevents subcutaneous emphysema and conventional rigid instruments can be applied, which is cost-effective [19-20].
In our series, one patient had port-site umbilical herniation 1 week postoperatively, who had thin abdominal wall (BMI of 19.9 kg/m^2). In previous reports, trocar-site herniation and infection was considered to be related to fascia of over 10 mm in size and its incomplete closure [20].
Therefore, it is important to repair the rectus fascia completely for the prevention of port-site herniation. In our series, rectus fascial edges were tagged with

suture for traction prior to port-system installation; this is useful for complete fascial closure at the end of the procedure.

A significant principle of laparoscopic surgery is the concept of triangulation. Triangulation enables facilitation of instrumental angular motion and leverage effect, thus assisting in dissection and reconstruction [8,15]. However, angular motion and leverage effect are considerably limited in single-port surgery due to the nature of the surgery. These act as hurdles for single-port surgery, especially for several operative procedures, such as reconstructive procedures. Therefore, surgeons need to better optimize the to-and-fro motion, instead of angular motion in single-port surgery.

Nevertheless, although single-port laparoscopic surgery has hurdles to overcome and requires more time and efforts from surgeons to acquire the skills, there is no fear and hesitation to perform this procedure.

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Table 1. Dermpgraphic characteristics of both group (SPA-LAVH versus MPA-LAVH, N=250)

	SPA-LAVH(n=120) Mean ± SD (range)	**MPA-LAVH(n=130) Mean ± SD (range)**	**P – value***
Age (years)	48.9±5.7 (36-75)	48.6±6.5(34-70)	0.760
Body Mass Index (Kg/m^2)	24.6 ± 2.9 (19.1-34.5)	23.5 ± 2.5 (18.7-32.9)	0.001
Parity	2.3±0.9 (0-5)	2.4±1.0(0-6)	0.599
Previous abdomino-pelvic surgery	34	29	0.273
Caesarean section	6	8	
Repeat Caesarean sections	6	8	
Three times Caesarean sections	5	4	
Myomectomy	0	2	
Tubal ligation	9	1	
Appendectomy	4	1	
Adnexal surgery	3	4	
Others	1	1	
Indication of hysterectomy			0.729
Leiomyoma	31	40	
Adenomyosis	24	29	
Adenomyosis coexisting leiomyoma	50	43	
Preinvasive lesion of uterine cervix coexisting adenomyosis or leiomyoma	7	9	
Adnexal disease	5	3	
Endometrial hyperplasia	2	4	
Others	1	2	

*: ***chi-square or Fisher's exact test***

Table 2. Surgical outcomes and complications of both group (SPA-LAVH versus MPA-LAVH, N=250)

	SPA-LAVH (N=120)	**MPA-LAVH (N=130)**	**P-value** **
	Mean ± SD (range)	**Mean ± SD (range)**	
Total operative time (min)	73.1 ± 24.3(35-180)	70.3 ± 22.1(35-150)	0.349
Largest dimension of uterus (cm)	10.7 ± 2.3 (6-15)	10.8 ± 2.8(5-16)	0.847
Weight of extirpated uterus (gram)	311 ± 185 (90-1007)	339 ± 234 (33-1380)	0.298
Hemoglobin drop (g/dL)	1.7 ± 0.8 (0.2-4.4)	2.0 ± 0.9 (0.3-5)	0.025
Intraoperative complications	**10**	**9**	**0.674**
Conversion to laparotomy	0	0	
Ancillary puncture	0	0	
Great vessel injury	0	0	
Bowel injury	0	0	
Bladder injury	1	2	
Ureter injury	0	0	
Blood transfusion	9	7	
Postoperative complications	**10**	**7**	**0.355**
Hemorrhage	5	5	
Paralytic ileus	4	2	
Sepsis	0	0	
Thromboembolic events	0	0	
Return to operating room	0	0	
Port-related umbilical hernia	1	0	

: ***student's t-test*