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단일공법 복강경하 질식자궁절제술 110예의 고찰 및 다공법과의 비교

가톨릭대학교 의과대학 산부인과학교실

박병준 · 김용욱 · 노덕영 · 김태응 · 류기성 · 김장흡

Evaluation of 110 cases of single-port access laparoscopically assisted vaginal hysterectomy (SPA-LAVH) and comparison with multi-port access

Byung-Joon Park, M.D., Yong-Wook Kim, M.D., Duck-Yeong Ro, M.D.,
Tae-Eung Kim, M.D., Ki-Sung Ryu, M.D., Jang-Heup Kim, M.D.

Department of Obstetrics and Gynecology,
The Catholic University of Korea, Incheon, Korea

Objective: To evaluate the safety and feasibility of single-port access laparoscopically assisted vaginal hysterectomy (SPA-LAVH) using conventional laparoscopic instruments compared to multi-port access laparoscopically assisted vaginal hysterectomy (MPA-LAVH).

Methods: We reviewed the medical records of 220 patients with uterine leiomyoma or adenomyosis who underwent 110 SPA-LAVH and 110 MPA-LAVH in Incheon St. Mary's Hospital between April 2007 and November 2009. We performed SPA-LAVH with conventional rigid straight laparoscopic instruments in all cases. We also performed a new vaginal cuff closure method, Kim's Vaginal Vault Suspension Method, named after the operator (Kim, YW) in both SPA-LAVH and MPA-LAVH.

Results: There was no significant difference in patients' age, operating time, uterine weight, hemoglobin change, frequency of blood transfusion, and incidence of postoperative fever between the two groups. The patients' mean age was 46.1±7.0 years (SPA-LAVH) and 45.5±6.3 years (MPA-LAVH). The mean operating time was 87.2±21.0 minutes (SPA-LAVH) and 83.3±20.3 minutes (MPA-LAVH). The mean uterine weight was 261.4±139.7 g (SPA-LAVH) and 257.8±132.9 g (MPA-LAVH). The mean hemoglobin change was 1.1±0.7 g/dL (SPA-LAVH) and 1.2±0.6 g/dL (MPA-LAVH). Neither bowel injury nor urinary tract injury occurred during the operation in the two groups. One of the SPA-LAVH and one of the MPA-LAVH cases were converted to abdominal total hysterectomy. The mean hospital stay time was shorter with SPA-LAVH (2.6±0.6 days [SPA-LAVH] and 3.3±0.7 days [MPA-LAVH], P<0.05).

Conclusion: SPA-LAVH using conventional rigid straight laparoscopic instruments can be offered as a safe and feasible alternative to MPA-LAVH.

Key Words: Single-port access, Multi-port access, Laparoscopically assisted vaginal hysterectomy, Conventional laparoscopic instruments

Laparoscopic surgery for hysterectomies is now being used as a result of a relatively recent development. Initially a laparoscopic hysterectomy required a longer intraoperative time than the traditional approaches, but as surgeons have moved along the learning curve, the necessary time has been reduced to the level of abdomi-

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교신저자 : 김용욱
E-mail : ywk@catholic.ac.kr

nal hysterectomy.[1] With the development of endoscopic techniques, laparoscopically assisted vaginal hysterectomy and total laparoscopic hysterectomy were added to this spectrum of choices beginning in the 1980s.

In 2008 and 2009, Yong-Wook Kim[2-4] reported the first single-port access total laparoscopic hysterectomy (SPA-TLH) and single-port access laparoscopically assisted vaginal hysterectomy (SPA-LAVH), which used the single-port system with a wound retractor and a surgical glove. The single-port system with a wound retractor and a surgical glove made the single-port surgery feasible. Minimally invasive surgery aims to provide effective treatment of surgical diseases while simultaneously decreasing access-related morbidity and reducing the invasiveness of the surgery. To achieve this goal, surgeons have proposed limiting the number of abdominal incisions or eliminating them completely.[5] Recently, the concept of natural orifice transluminal endoscopic surgery (NOTES) has emerged; however, the NOTES concept is still research based.[6-8]

In this paper, we report comparison of SPA-LAVH versus multi-port access laparoscopically assisted vaginal hysterectomy (MPA-LAVH), providing details on the operative results and complication rates as well as a detailed description of the procedure.

Materials and Methods

We reviewed the medical records of 220 patients with uterine leiomyoma and/or adenomyosis who underwent 110 SPA-LAVH and 110 MPA-LAVH by the same medical team in the Department of Obstetrics and Gynecology of Incheon St. Mary's Hospital, The Catholic University of Korea, between April 2007 and November 2009. We obtained Institutional Review Board approval from the ethical committee of our institution and obtained informed patient consent for all surgeries. In all patients, we took a history and performed a physical examination, pelvic examination, Papanicolaou test, and pelvic ultrasonography. We excluded patients who exhibited severe obesity (body mass index >35), or who were at high risk for general anesthesia. The patients were informed of the risks and complications of the procedure before the laparoscopy.

1. Surgical technique

1) Kim's Vaginal Vault Suspension Method

In both SPA-LAVH and MPA-LAVH, we performed a new vaginal cuff closure method, "Kim's Vaginal Vault Suspension Method", named after the operator (Kim,

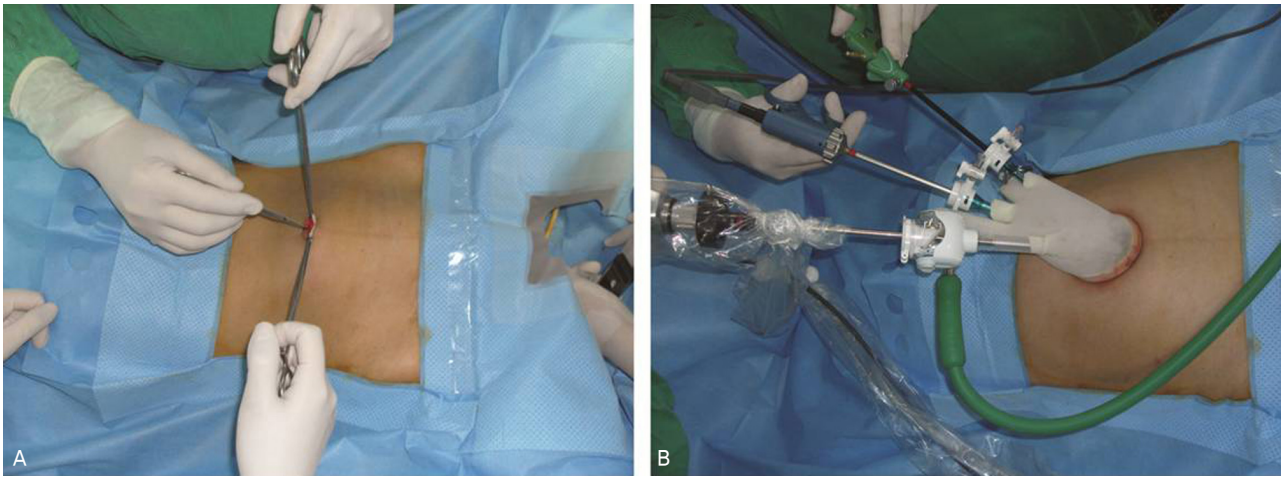

Fig. 1. (A) Performing a 1.5 to 2.0 cm intra-umbilical vertical skin incision. (B) Using conventional rigid straight laparoscopic instruments in handmade single-port system.

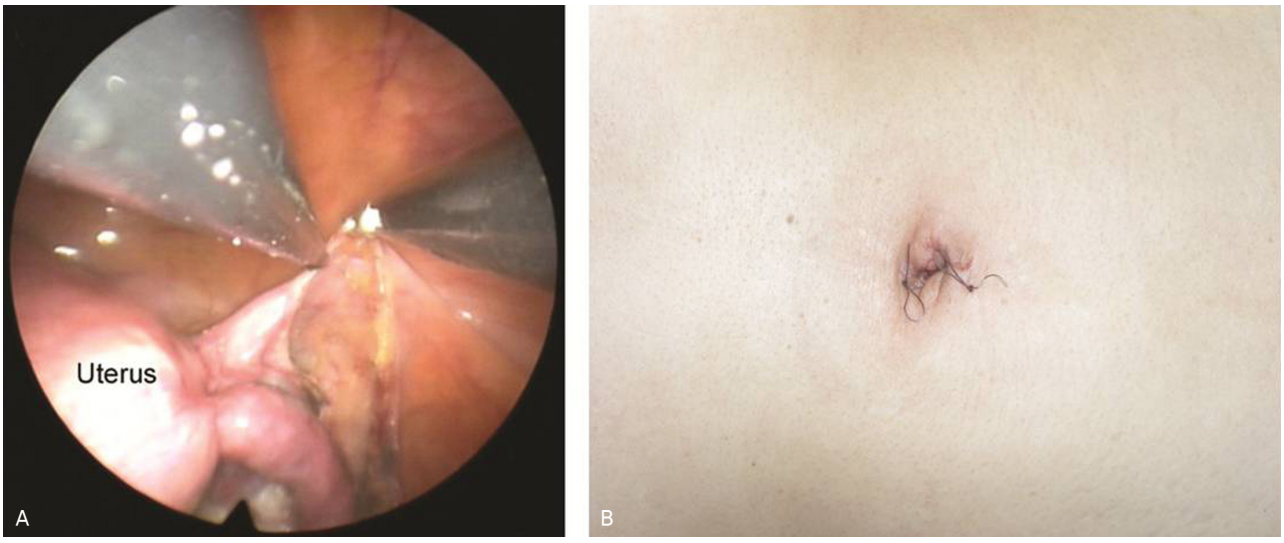

Fig. 2. (A) Laparoscopic view of single-port procedure. (B) Subcuticular suture of umbilical skin.

YW). After removing the uterus through the vagina, the peritoneum was closed using a continuous absorbable suture (#2/0 Vicryl). Left cardinal or broad ligaments which had been ligated last in the vaginal phase were ligated again with right same parts to make a complex. The closed peritoneum was sutured to the complex of cardinal or broad ligaments. The vaginal mucosa was also sutured to the complex of cardinal or broad ligaments, and was closed with a continuous absorbable suture (#2/0 Vicryl) either horizontally or vertically. This suspension method was also advantageous to control bleeding.

2) MPA-LAVH

MPA-LAVH was done under general anesthesia with the patients in a lithotomy position. After sterile coverage, we inserted the KOH Colpotomizer™ system (CooperSurgical, Shelton, CT, USA), which consisted of a vaginal extender (KOH Cup™ vaginal fornices delineator) and a uterine manipulator (RUMI® uterine manipulator), into the vagina and uterus.[9] We performed a small vertical umbilical incision for placing the Veres needle. After insufflation of CO_2 to a limited pressure of 12 mm Hg, a 10 mm trocar was placed and the camera was inserted. Further two 5 mm trocars were placed in the lower abdomen, laterally left and right. If necessary, pelvic adhesiolysis was done.

When the ovaries were to be conserved, the fallopian tubes, round and ovarian ligaments were resected with bipolar electrocautery forceps and monopolar scissors. When adnexectomy was needed, the mesosalpinx and infundibulopelvic ligaments were resected. Laparoscopic dissection of broad ligaments and bladder flap were performed. We occasionally opened anterior and/or posterior vaginal fornices either with monopolar hook electrode or scissors in some cases. Moving on further, we proceeded to the vaginal phase which included clamping, transecting, and suture ligating of uterine vessels, cardinal and uterosacral ligaments. After removing the uterus through the vagina, Kim's Vaginal Vault Suspension Method was performed. Because the uterine vessels were cut and ligated during the vaginal phase, this procedure was classified as LAVH[10] or type I in the classification system proposed by Munro and Parker.[11] After closing the vagina, the operation field in the pelvic cavity was checked for bleeding.

3) SPA-LAVH

We used a surgical glove and a small wound retractor

Table 1. Patient characteristics and pathologic diagnoses

	SPA-LAVH (n=110)	MPA-LAVH (n=110)	*P*-value
Age (yr)	46.1±7.0	45.5±6.3	NS
BMI	23.7±3.5	23.9±3.6	NS
Nulliparous	6 (5.5%)	4 (3.6%)	NS
Previous abdominal surgery	43 (39.1%)	39 (35.5%)	NS
Pathologic diagnoses of uterus after hysterectomy			NS
Myoma uteri	57 (51.8%)	63 (57.3%)	
Myoma uteri and adenomyosis	32 (29.1%)	23 (20.9%)	
Adenomyosis	21 (19.1%)	24 (21.8%)	

Values are mean±standard deviation or number (%).
SPA-LAVH: single-port access laparoscopically assisted vaginal hysterectomy, MPA-LAVH: multi-port access laparoscopically assisted vaginal hysterectomy, BMI: body mass index, NS: not significant.

Table 2. Comparison of Operative outcomes

	SPA-LAVH (n=110)	MPA-LAVH (n=110)	*P*-value
Mean duration of operation (min)	87.2±21.0	83.3±20.3	NS
Mean uterine weight (g)	261.4±139.7	257.8±132.9	NS
Mean change in hemoglobin (g/dL)	1.1±0.7	1.2±0.6	NS
Bowel or urinary tract injury	None	None	NS
Frequency of blood transfusion during operation	1 (0.9%)	None	NS
Conversion to laparotomy	1 (0.9%)	1 (0.9%)	NS
Incidence of postoperative fever	1 (0.9%)	None	NS
Mean length of hospital stay (day)	2.6±0.6	3.3±0.7	<0.05

Values are mean±standard deviation or number (%).
SPA-LAVH: single-port access laparoscopically assisted vaginal hysterectomy, MPA-LAVH: multi-port access laparoscopically assisted vaginal hysterectomy, NS: not significant.

(Alexis® wound retractor X-Small; Applied Medical, CA, USA) as the single-port equipment.[2-4] After we performed a single vertical umbilical incision and identified the peritoneal cavity, we inserted the wound retractor through the umbilical incision (Fig. 1A). Next, a surgical glove that had three cannulas tightly attached was fixed to the outer ring of the wound retractor. The cannula sizes were different. Two of them were 5 mm in diameter, and one was 10 mm in diameter for the instruments with shafts of 10 mm diameter. We performed all SPA-LAVH cases using this single-port equipment and conventional rigid straight laparoscopic instruments (Figs. 1B, 2A).

We began with a 1.5 to 2.0 cm vertical umbilical skin incision and a rectus fasciotomy to enter the peritoneal cavity. After placement of the single-port device into the umbilical incision, the abdomen was insufflated to a limited pressure of 12 mm Hg with carbon dioxide. The rigid 0 or 30 degree 5 mm laparoscope and the rigid 5 mm laparoscopic instruments were inserted in the abdomen. The overall procedure of SPA-LAVH was similar to MPA- LAVH. After removing the uterus through the vagina, Kim's Vaginal Vault Suspension Method was performed. The surgical glove was detached from the outer ring of the wound retractor, followed by removing the wound retractor. The umbilical fascia was closed with #1 Vicryl suture. We performed a subcuticular suture with #4/0 Vicryl for the skin closure (Fig. 2B).[4]

2. Outcome measurements

We conducted an analysis of several factors including

the characteristics of the benign uterine disease, previous abdominal surgery, the hematologic changes which occurred between the preoperative and the postoperative phases, the operative time, the complications, the incidence of procedure conversion, and the lengths of hospital stay. Fever was defined as a postoperative temperature >38.0℃. We measured the duration of operation from the first skin incision to the last suture of the skin wound. All data were analyzed using Fisher's exact or chi-square tests for categorical variables and Student's *t*-test for continuous variables. *P*-values <0.05 were considered statistically significant.

Results

Table 1 shows the clinical characteristics of the patients, including the pathologic diagnoses of uterus after hysterectomy. There was no difference in demographic and pathologic data between the two groups. The patients' mean age was 46.1±7.0 years (SPA-LAVH) and 45.5±6.3 years (MPA-LAVH). The operative data are summarized in Table 2. The mean operating time was 87.2±21.0 minutes (SPA-LAVH) and 83.3±20.3 minutes (MPA-LAVH). The mean uterine weight was 261.4±139.7 g (SPA-LAVH) and 257.8±132.9 g (MPA-LAVH). The mean hemoglobin change was 1.1±0.7 g/dL (SPA-LAVH) and 1.2±0.6 g/dL (MPA-LAVH). There was no significant difference in operating time, uterine weight, hemoglobin change, frequency of blood transfusion, and incidence of postoperative fever between the two groups. Neither bowel injury nor urinary tract injury occurred during the operation in the two groups. One of the SPA-LAVH and one of the MPA-LAVH cases were converted to abdominal total hysterectomy. The mean hos pital stay time was shorter with SPA-LAVH than with MPA-LAVH (2.6±0.6 days [SPA-LAVH] and 3.3±0.7 days [MPA-LAVH], $P<0.05$). In all patients, no postoperative complications were observed at the 1 month follow-up.

Discussion

The present study shows that SPA-LAVH can be safely and easily accomplished using conventional rigid straight laparoscopic instruments in patients with benign uterine disease. This single-port system has several functions and advantages. Single-port access laparoscopic surgery requires few special instruments, unlike NOTES, and it can easily convert to a multi-port access procedure if necessary. The wound retractor widens the umbilical incision site. It makes possible the simultaneous transit of the conventional laparoscopic instruments, which are 5 to 10 mm in size, into a small umbilical incision which is 1.5 to 2.0 cm in size. Also, the wound retractor prevents subcutaneous emphysema and the surgical glove controls gas insufflation well during the operation.

Trocar insertion is still the most dangerous technical aspect of laparoscopy.[12] Most complications during laparoscopic surgery occur not only during the initial entry of instrument, such as an insufflation needle into the abdomen, but also during the insertion of ancillary ports. When ancillary ports are inserted, it can lead to injury to the inferior epigastric vessels.[13] Moreover, trocar site herniation and infection may occur at port sites as small as 5 mm in size.[14] In the single-port method, the device is inserted through the umbilicus as a single pathway, and these complications are completely avoided. Furthermore, the decrease in the number of trocars used has led to a reduction in the amount of postoperative pain.[15] Other comparison studies have reported that single-port operation is a feasible method for hysterectomy with comparable surgical outcomes and postoperative pain scores when compared with conventional laparoscopic hysterectomy.[16,17]

The most notable limitation for single-port access laparoscopic surgery is the crowding and clashing of instruments because the port is crammed with instruments. However, the results of our study show

that the SPA-LAVH is safe and feasible. This study is more meaningful in that we used our handmade single-port system and conventional laparoscopic instruments without special instruments. Other studies used special instruments such as articulated instruments, R-port (QuadPort; Advanced Surgical Concepts, Dublin, Ireland), and Endo-GIA (a single-use loading unit with titanium staples created by Autosuture Tyco Healthcare, Norwalk, CT, USA) during single-port access laparoscopic hysterectomy.[18,19] In this study, no additional cost, associated with the use of commercial equipment for single-port access laparoscopic surgery, was required.

In conclusion, our study shows that there was no significant difference in operating time and complication rates between SPA-LAVH and MPA-LAVH. In addition, SPA-LAVH was associated with reduced postoperative hospital stay compared to MPA-LAVH. Although single-port access laparoscopic surgery has limitations and requires more time and effort for surgeons to acquire the skills, SPA-LAVH can be a safe and effective alternative to MPA-LAVH with improved equipment and operator training.

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= 국문초록 =

목적: 통상적인 복강경기구만을 사용한 단일공법 복강경하 질식자궁절제술을 다공법 복강경하 질식자궁절제술과 비교하여 안전성 및 유용성을 평가하고자 하였다.

연구 방법: 2007년 4월부터 2009년 11월까지 인천성모병원에서 자궁근종 또는 자궁샘근증의 질환으로 단일공법 복강경하 질식자궁절제술을 시행받은 환자 110명과 다공법 복강경하 질식자궁절제술을 시행받은 환자 110명, 총 220명의 환자를 대상으로 하였다. 우리는 모든 수술에서 통상적으로 사용되는 구부러지지 않는 일직선의 복강경기구를 사용하였다. 또한 단일공법 및 다공법 복강경하 질식자궁절제술 둘 다에서 수술자 (Kim, YW)의 이름을 따서 명명한 새로운 질단부 봉합 방법인 "김씨 질구개 현수법 (Kim's Vaginal Vault Suspension Method)"을 사용하였다.

결과: 환자 나이, 수술 시간, 자궁의 무게 , 혈색소 수치의 변화, 수혈 빈도, 수술 후 발열에서 두 군 간에 유의한 차이를 보이지 않았다. 환자들의 평균 나이는 46.7±7.0세 (단일공법)와 45.5±6.3세 (다공법)이었다. 평균 수술 시간은 87.2±21.0분 (단일공법)과 83.3±20.3분 (다공법), 평균 자궁의 무게는 261.4±139.7 g (단일공법)과 257.8±132.9 g (다공법), 평균 혈색소 수치의 변화는 1.1±0.7 g/dL (단일공법)와 1.2±0.6 g/dL (다공법)이었다. 두 군 모두에서 수술 중 장 또는 요로의 손상은 없었다. 두 군 모두에서 각각 한 건의 개복수술로의 전환이 있었다. 단일공법을 시행한 군에서 입원 기간이 유의하게 짧았다 (2.6±0.6일 [단일공법], 3.3±0.7일 [다공법], $P<0.05$).

결론: 통상적으로 사용하는 구부러지지 않는 일직선의 복강경기구를 이용한 단일공법 복강경하 질식자궁절제술은 다공법 복강경하 질식자궁절제술에 대한 안전하고 유용한 대체 수술이 될 수 있다.

중심단어: 단일공법, 다공법, 복강경하 질식자궁절제술, 통상적인 복강경기구