Original Article

Single Port Access Laparoscopic-Assisted Vaginal Hysterectomy for Large Uterus Weighing Exceeding 500 Grams: Technique and Initial Report

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ABSTRACT

Study Objective: To present our initial experience with single-port access laparoscopic-assisted vaginal hysterectomy (SPA-LAVH) in a large uterus weighing in excess of 500 g.

Design: A prospective single-center study (Canadian Task Force classification III).

Setting: University hospital

Patients: Fifteen patients with an extirpated uterine weight of more than 500 g were enrolled from May 2008 to September 2009.

Interventions: SPA-LAVH.

Measurements and Main Results: There were 11 cases with uterine myomas and 4 cases of adenomyosis. All patients had symptoms related to these diagnoses including menorrhagia, dysmenorrhea, and pelvic pressure symptoms such as urinary frequency. The median and range are used to describe data not distributed normally. The median operation time, weight of the uterus, and estimated blood loss were 125 minutes (80 to 236 minutes), 690 g (503 to 1260 g), and 500 mL (150 to 1000 mL), respectively. There was a significant linear correlation between the operation time and the extirpated uterine weight (p < .002). Thirteen procedures were successfully performed with SPA-LAVH. The SPA procedure failed in 2 cases: 1 (uterine weight, 732 g) required 1 ancillary 5-mm port to manipulate with a myoma screw, and in the other we inserted 1 additional 15-mm port to use for a laparoscopic morcellator. There were no umbilical complications, additional procedures, or surgical complications.

Conclusion: The SPA-LAVH procedure for a large uterus weighing in excess of 500 g was as safe and effective as the conventional LAVH. Additional experience and continued investigation are warranted.

Journal of Minimally Invasive Gynecology (2010) 17, 456–460 © 2010 AAGL. All rights reserved.

Keywords: Single port; Laparoscopic-assisted vaginal hysterectomy; Large uterus

Laparoscopic-assisted vaginal hysterectomy (LAVH) has become an alternative to the standard transabdominal hysterectomy; it is currently accepted as a safe and efficient method for managing benign gynecologic disease, with the special advantages of reduced frequency of complications and more rapid recovery [1]. LAVH can be safely and successfully used for complicated cases including a large uterus and severe adhesions.

Recently, a procedure even less invasive than the conventional LAVH has been introduced, the single-port access (SPA) LAVH. The SPA-LAVH further enhances the cosmetic benefits of minimally invasive surgery while minimizing the potential morbidity associated with multiple incisions. Preliminary advances in SPA surgery as applied to urologic and gastrointestinal surgery have demonstrated that the technique is feasible, provided that both optimal technical expertise with advanced skills and optimal instrumentation are available [2,3]. Then there have been a few reports of SPA surgery in the field of gynecology [4-9].

Generally a large uterus weighing at least 500 g significantly distorts the pelvic anatomy. It may have an extensive
vascular supply and compromise the operative field. The rate of conversion to laparotomy for conventional LAVH with a large uterus (>500 g) has been reported to be higher than with a more average-sized uterus (23% to 27%) [10,11]. In SPA-LAVH, a large uterus will be considered as more difficult for extirpation. With the SPA-LAVH, a large uterus is more difficult to remove. The purpose of this study was to estimate the safety and efficacy of the SPA-LAVH for the treatment of large uteri in a prospective cohort study.

Materials and Methods

This study was approved by the institutional review board at the Samsung Medical Center (Seoul, Korea). From May 2008 through September 2009, 90 consecutive patients undergoing SPA-LAVH for benign gynecologic diseases by a single surgeon (T.J.K.) at Samsung Medical Center were recruited. During the same period, no patient had an elective conventional LAVH; all patients were treated exclusively with a SPA-LAVH. All data were collected prospectively. Before surgery, ultrasonography was performed to assess the uterine length (largest sagittal distance between the level of the internal os and the top of the uterine fundus) and uterine thickness (the greatest width between the anterior and the posterior uterine walls) and to evaluate the size and location of fibroids and concomitant adnexal disease. In the operating room the uterine weight (in grams) was measured immediately after the specimen was removed. In 15 of 90 (16.6%) patients, a uterus weighing more than 500 g was removed. These patients were enrolled in this study. The operation time was recorded electronically and was defined as the interval between starting the incision to closure. The body mass index (BMI, kg/m²) was determined by the standard World Health Organization criteria. The estimated blood loss was made by the anesthesiologist using the total suction canister volume minus the irrigation volume, plus the difference between the sponge weights after use minus dry. The surgical indications for the SPA-LAVH were the same as for the conventional LAVH, which uses 3 or more ports. The median and range are used to describe data that was not normally distributed. The Mann-Whitney U Test and Spearman’s correlation analysis were used for the statistical analysis.

Operative Techniques

Surgical procedures were performed with a wound retractor with a glove system that has been previously described [5]. In brief, a 2-cm vertical incision was made within the umbilicus and a small wound retractor (Alexis; Applied Medical, Rancho Santa Margarita, CA) was inserted into the wound opening. This made the small vertical incision a wider, rounder opening. A surgical glove, with 3 sheaths that were inserted through the cut edges of the distal finger tips and tied with an elastic bandage to prevent leakage of carbon dioxide, was draped around the rim of the wound retractor. A uterine elevator was inserted to provide an effective surgical field. We used a 5-mm, 0-degree, rigid laparoscope and an articulating instrument (i.e., Roticulator; Covidien, Norwalk, CT) to avoid clashing of the instruments and to optimize the range of motion, because the trocars moved within the glove channel. The ovarian ligaments, round ligament, and broad ligament were dissected by a 45-mm Endo-GIA (a single-use loading unit with titanium staples created by Covidien). After the ligaments were dissected bilaterally and the bleeding was controlled, we started the vaginal hysterectomy. After all procedures were completed, skin adhesive (Dermabond; Ethicon, Somerville, NJ) was used to close the skin; this was used because of its good cosmetic effects and patient convenience.

Results

The demographic data are detailed in Table 1. There were 11 cases with uterine myomas and 4 with adenomyosis. The correlation between hemoglobin drop and EBL was r = .540 (p = .038). All patients had symptoms related to these diagnoses including menorrhagia, dysmenorrhea, and pelvic pressure symptoms such as urinary frequency. The median parity was 2, and BMI was 24.0.

The SPA-LAVH procedure failed in 2 cases: in 1 (uterine weight, 732 g) an ancillary 5-mm port was needed to ensure the visualization at the right lateral quadrant of the abdomen, because of a distorted uterine cornua that interfered with securing the uteroovarian ligaments; the other failed case had a 1149-g uterus, confined to the pelvis, that prohibited downward traction of the uterus during the vaginal phase of the hysterectomy. A transvaginal volume reduction technique was not feasible. We inserted 1 additional 15-mm port to use the 5mm morcellator (WISAP; 15mm serrated blade, Sauerlach-Munchen, Germany) at the left lateral quadrant of the abdomen after securing the uterine artery transvaginally. In the remaining 13 cases, the SPA-LAVH was successfully performed. In the largest uterus weighing 1260 g, the uterine mass was composed mainly of a cervical myoma and had the shape of a snowman. We dissected the round ligaments, tubes, and uteroovarian ligaments with a 45-mm Endo-GIA easily during the laparoscopic phase, and performed a posterior colpotomy followed by a cervical myomectomy during the vaginal phase. This uterine volume reduction facilitated the subsequent vaginal hysterectomy. Conversion to a laparotomy did not occur. The various additional SPA procedures performed included salpingectomy (n = 1), adnexectomy (n = 2), ovarian wedge resection (n = 1), adhesiolysis (n = 3), and an appendectomy (n = 1) performed by a gastrointestinal surgeon.

The median operation time, weight of the uterus, and estimated blood loss were 125 minutes (80 to 236 minutes), 690 g (503 to 1260 g), and 500 mL (150 to 1000 mL), respectively. The decrease in the hemoglobin from before surgery to postoperative day 1 was from 0.2 to 4.5 g/dL, with a median of 2.4 g/dL. The median hospital stay (postoperative day) was 3 days (2 to 3). Fig. 1 shows a significant linear correlation between the operative time and the extirpated uterine...
However, the estimated blood loss and decline in hemoglobin were not significantly associated with uterine weight ($p = .231$, $p = .595$, respectively).

We have encountered no umbilical complications to date with the single port. In particular, there was 1 patient who had a history of an umbilical hernia that occurred after a previous laparoscopic tubal sterilization. She did not complain of any umbilical events 6 months after the surgery. All patients were followed up in the clinic for at least 3 weeks after surgery, and all recovered uneventfully. There was patient who required additional procedures or had development of surgical complications at a median follow-up of 5 months (range 1 to 14 months).

### Discussion

The results of this study show that the SPA-LAVH for a large uterus weighing at least 500 g had a success rate of 86.6%, and conversion to laparotomy did not occur. During the same period, SPA-LAVH for a uterus weighing less than 500 g had a success rate of 94.6% (71 of 75 cases), with 1 case of conversion to a laparotomy. The study population did not differ from the general group of patients that underwent conventional LAVH [11].

The benefits of the SPA-LAVH include the following:

- First, we could avoid the Veres needle and injury from the first trocar, including abdominal vessel or muscle injury and intra-abdominal organ damage, because we used an open Hasson technique within the umbilicus. Furthermore, this procedure made closing the fascia layer easier because of the larger incision compared with the 12-mm trocar incision.
- Second, a better cosmetic outcome was possible by limiting the number of port incisions to only 1 site and hiding the scar within the umbilicus, without any wound complications.
- Third, an umbilical port avoided penetrating any muscle, thereby possibly lessening postoperative pain.
- Fourth, if needed, we could easily convert to a conventional LAVH; in the 2 cases with conversion to the conventional LAVH, 1 or 2 more trocars were enough to secure the viewing angle and perform adhesiolysis and morcellation.

Ligation of the adnexal collateral vessels through a laparoscopic approach and bilateral uterine artery ligation through the vaginal approach are the mainstays of bleeding control in LAVH procedures. Usually, the fundus of a uterus weighing >500 g (as large as the fifth month of a pregnancy) will be near the umbilicus. The trocars used with conventional LAVH could be inserted more cephalad than usual to avoid direct puncture into the bulky uterus and to provide a comprehensive view of the operative field. By contrast, the SPA-LAVH may be limited by the scope for viewing, because the only entry site is the umbilicus. In particular, a bulky uterus with distorted uterine cornua frequently interferes with securing of the adnexal collaterals; however, efficient uterine manipulation with a myoma screw, through the single port and a uterine elevator through vagina, helps achieve the goals of the procedure. However, as illustrated in one of the

### Table 1

<table>
<thead>
<tr>
<th>Patients</th>
<th>Age</th>
<th>BMI</th>
<th>Pathology</th>
<th>HD</th>
<th>Ancillary port</th>
<th>Additional procedures</th>
<th>OP time</th>
<th>Hb drop</th>
<th>EBL (pRBC)</th>
<th>Uterine weight (g)</th>
<th>OP procedure</th>
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<tbody>
<tr>
<td>1</td>
<td>45</td>
<td>22.1</td>
<td>Myoma</td>
<td>2</td>
<td>One 5-mm port</td>
<td>Right salpingectomy</td>
<td>5-10</td>
<td>145</td>
<td>400</td>
<td>503</td>
<td>Cesarean section</td>
</tr>
<tr>
<td>2</td>
<td>45</td>
<td>22.6</td>
<td>Myoma</td>
<td>2</td>
<td>Not used</td>
<td>Appendectomy</td>
<td>6-10</td>
<td>110</td>
<td>0.2</td>
<td>90</td>
<td>LUTS, Cesarean section</td>
</tr>
<tr>
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<td>47</td>
<td>18.2</td>
<td>Myoma</td>
<td>2</td>
<td>Not used</td>
<td>Adhesiolysis</td>
<td>4-8</td>
<td>0.2</td>
<td>350</td>
<td>90</td>
<td>LUTS, Cesarean section</td>
</tr>
<tr>
<td>4</td>
<td>49</td>
<td>24</td>
<td>Myoma</td>
<td>2</td>
<td>Not used</td>
<td>Adhesiolysis</td>
<td>2-4</td>
<td>3.6</td>
<td>200</td>
<td>100</td>
<td>LUTS, Cesarean section</td>
</tr>
<tr>
<td>5</td>
<td>54</td>
<td>24.8</td>
<td>Adenomyosis</td>
<td>3</td>
<td>Not used</td>
<td>Laparoscopic surgery because of endometriosis</td>
<td>4-8</td>
<td>2.3</td>
<td>700</td>
<td>860</td>
<td>LUTS, Cesarean section</td>
</tr>
<tr>
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<td>28.8</td>
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<td>3</td>
<td>Not used</td>
<td>Adhesiolysis</td>
<td>2-4</td>
<td>2.1</td>
<td>200</td>
<td>840</td>
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</tr>
<tr>
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<td>Not used</td>
<td>Adhesiolysis</td>
<td>2-4</td>
<td>0.2</td>
<td>350</td>
<td>94</td>
<td>LUTS, Cesarean section</td>
</tr>
<tr>
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<td>Myoma</td>
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<td>Not used</td>
<td>Adhesiolysis</td>
<td>2-4</td>
<td>2.1</td>
<td>200</td>
<td>84</td>
<td>LUTS, Cesarean section</td>
</tr>
<tr>
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<td>Adhesiolysis</td>
<td>2-4</td>
<td>0.2</td>
<td>350</td>
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</tr>
<tr>
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<td>Not used</td>
<td>LUTS, Cesarean section</td>
<td>2-4</td>
<td>2.1</td>
<td>200</td>
<td>84</td>
<td>LUTS, Cesarean section</td>
</tr>
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<td>Adhesiolysis</td>
<td>2-4</td>
<td>2.1</td>
<td>200</td>
<td>84</td>
<td>LUTS, Cesarean section</td>
</tr>
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<td>2-4</td>
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<td>350</td>
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<td>LUTS, Cesarean section</td>
</tr>
<tr>
<td>14</td>
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<td>18.4</td>
<td>Myoma</td>
<td>3</td>
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<td>Adhesiolysis</td>
<td>2-4</td>
<td>2.1</td>
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<td>84</td>
<td>LUTS, Cesarean section</td>
</tr>
<tr>
<td>15</td>
<td>39</td>
<td>21.5</td>
<td>Myoma</td>
<td>3</td>
<td>Not used</td>
<td>Adhesiolysis</td>
<td>2-4</td>
<td>0.2</td>
<td>350</td>
<td>94</td>
<td>LUTS, Cesarean section</td>
</tr>
</tbody>
</table>

HD = Postoperative hospital day; OP = operative; Hb = hemoglobin; EBL = estimated blood loss calculated as difference between total amount of suction and irrigation plus difference between total weight of gauzes after and before surgery; pRBC = packed red blood cell; LUTS = unilateral salpingo-oophorectomy; LAVH = laparoscopic-assisted vaginal hysterectomy.
failed cases, we could not perform a single-port access because of a severely distorted cornus. In retrospect, the additional port insertion could have been avoided if we used a flexible scope; however, that was not available at our center at that time. Sometimes an extremely large uterus, confined to the pelvis, prohibited downward traction of the uterus during the vaginal phase of the hysterectomy. Volume reduction techniques through the laparoscopic with mechanical morcellation of the bulky corpus and transvaginal manual morcellation of the lower uterine segment followed by the vaginal hysterectomy helps overcome this problem. If we had had a small diameter and nonserrated morcellator to insert through our SPA device, the SPA-LAVH could have been carried out successfully with reduced operative time and blood loss.

SPA-LAVH for an extremely large uterus may difficult, but not impossible. In this study, 4 patients had extirpated uteri weighting >900 g, and a combination of the above procedures was required to achieve a successful SPA-LAVH; however, they required a longer operative time. These results are consistent with those of conventional LAVH [12]. Although a longer operative time and more blood loss might be anticipated in cases with a large uterus, the complication rate and the length of hospital stay were not significantly increased. Of note is that there was no significant association of the estimated blood loss and decline in hemoglobin with the uterine weight, although bleeding and a drop in the hemoglobin were noticeable in cases with a large uterus weighing in excess of 500 g compared with a uterus weighing less than 500 g. However, generalizations cannot be made on the basis of the small sample size, and blood loss may be related to the shape and location of the individual myomas rather than the uterine weight.

The SPA-LAVH for large uterus has been believed to be associated with a longer operative time, more complications, and a higher conversion rate to conventional LAVH or laparotomy. However, with the use of a variety of special strategies, as described above, and advancements in equipment, the SPA-LAVH can be safely and successfully performed in women with a large uterus. Additional experience and continued investigation are needed.

References


