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RESEARCH ARTICLE

Laparoscopic-assisted Vaginal Hysterectomy *vs* Hand-assisted Laparoscopic Hysterectomy

[1]Sheriff Z Kotb, [2]Mohamed El-Metwally, [3]Nazem Shams, [4]Ashraf Khater

ABSTRACT

Objectives and background: The use of laparoscopic techniques now permits combination of benefits of both abdominal and vaginal hysterectomy. But, laparoscopic hysterectomy has been associated with a higher risk of urinary tract injury compared with abdominal and vaginal procedures, and the risks of these minimally invasive approaches must be balanced with the benefits. Hand-assisted laparoscopic surgery was first described in the early 1990s as a surgical method designed to facilitate the performance of challenging laparoscopic procedures while maintaining the advantages of a minimally invasive approach.

Our present study aims to compare between laparoscopic-assisted vaginal hysterectomy (LAVH) and hand-assisted laparoscopic hysterectomy (HALH).

Materials and methods: This study was conducted at the Oncology Center of Mansoura University (OCMU). A total of 41 sequential patients scheduled for hysterectomy were divided randomly (patient by patient) into two groups: group 1 included 21 patients who underwent LAVH and group 2 included 20 patients who underwent HALH from August 2010 to March 2013.

Patients were excluded from this study if they had contraindications to either vaginal hysterectomy, such as several prior abdominal surgeries, vaginal stenosis, or severe endometriosis, or to laparoscopy, including underlying medical conditions that could be worsened by pneumoperitoneum or the Trendelenburg position. Body mass index was not a limiting factor for patient inclusion in the study.

Results: The clinical characteristics of the 41 patients were similar as regards age, parity, and uterine size. The indications for hysterectomy among the study groups were nearly similar. No statistically significant difference was found between the two groups in operative time. Operative blood loss was higher in the LAVH group. Two cases in the LAVH group were converted to laparotomy to control bleeding and to repair a urinary bladder tear.

Conclusion: The HALH group had less analgesic consumption, earlier ambulation, shorter hospital stay, and earlier regain of daily and coital activities. On the contrary, the HALH group had much more direct costs, which requires much effort to be directed toward this fruitful technique and more training programs to surgeons to increase their experience in enriching hand skills in this emerging technique.

Keywords: Hand-assisted laparoscopy surgery (HALS), Hysterectomy, Laparoscopic-assisted vaginal hysterectomy.

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[1-3]Professor, [4]Assistant Professor

[1-4]Department of Surgical Oncology, Mansoura Oncology Center, Faculty of Medicine, Mansoura University, Dakahlia Egypt

Corresponding Author: Sherif Zaki Kotb, Professor Department of Surgical Oncology, Mansoura Oncology Center Faculty of Medicine, Mansoura University, Dakahlia, Egypt Phone: 0201005133536, e-mail: drsherifkotb60@yahoo.com

INTRODUCTION

Hysterectomy is one of the most commonly performed major gynecological procedures.[1] Approximately 494,000 hysterectomies are performed annually in the United States, making this procedure one of the most commonly performed surgeries in women of reproductive age.[2]

The optimum approach to hysterectomy would retain the advantage of abdominal route which includes clear visualization and easy manipulation of the adnexal structures, and advantage of vaginal hysterectomy, namely avoidance of a large abdominal incision. The use of laparoscopic techniques now permits combination of these benefits. But, laparoscopic hysterectomy has been associated with a higher risk of urinary tract injury compared with abdominal and vaginal procedures, and the risks of these minimally invasive approaches must be balanced with the benefits.[3]

The laparoscopic approach requires a higher level of technical skills, especially with total laparoscopic hysterectomy (TLH) for which the entire procedure, including suturing of the vaginal cuff, is performed by laparoscopic route.[4]

Currently, there are several methods of laparoscopic hysterectomy including laparoscopic-assisted vaginal hysterectomy (LAVH), hand-assisted laparoscopic hysterectomy (HALH), TLH, and, more recently, robotic hysterectomy. Three main types of hysterectomy are now used: Abdominal, vaginal, and laparoscopic. Laparoscopic assisted vaginal hysterectomy has already gained widespread acceptance since it was first reported by Reich et al in 1989.[5]

Laparoscopic-assisted vaginal hysterectomy has become a popular alternative to abdominal hysterectomy in cases that are difficult to manage via the vaginal route alone.[6]

Laparoscopic-assisted vaginal hysterectomy is now regarded as a safe and feasible technique for managing uterine diseases, because it offers minimal postoperative discomfort, less blood loss, shorter hospital stay, rapid convalescence, and an early return to activities of daily living.[7]

Hand-assisted laparoscopic surgery was first described in the early 1990s to facilitate the performance of challenging laparoscopic procedures while maintaining the advantages of a minimally invasive approach.[8]

In this technique, the surgeon's nondominant hand is introduced into the abdominal cavity by means of a hand-port device while maintaining pneumoperitoneum. The dominant hand is then used to manipulate instruments in concert with a surgical assistant. Hand-assisted laparoscopy combines the benefits of laparoscopy with advantages of a conventional laparotomy, allowing for improved exposure, manual exploration, blunt dissection, and immediate control of hemostasis.[9]

MATERIALS AND METHODS

This cross-sectional study included 41 sequential patients scheduled for hysterectomy at the Oncology Center, Mansoura University (OCMU) who were divided randomly (patient by patient) into two groups: Group 1 included 21 patients who underwent LAVH and group 2 included 20 patients who underwent HALH from August 2010 to March 2013.

Patients were excluded from this study if they had contraindications to either vaginal hysterectomy, such as several prior abdominal surgeries, vaginal stenosis, or severe endometriosis, or to laparoscopy, as underlying medical conditions that could be worsened by pneumoperitoneum or the Trendelenburg position. Body mass index (BMI) was not a limiting factor for patient inclusion in the study.

Full history and general, abdominal, and vaginal examinations were conducted for every patient. Complete blood count, liver and renal functions, and electrocardiography were ordered too. An informed consent for every patient was obtained. All patients underwent the same standard preparation prior to surgery, including antibiotic prophylaxis and administration of low molecular weight heparin.

Group 1: Laparoscopic-assisted vaginal hysterectomy

A peritoneal access is performed with a 10-mm sheath placed infraumbilically using closed (Veress needle) or open (Hasson trocar) technique. Carbon dioxide is insufflated with a high-flow (>3 l/min) insufflator at pressures of <15 mm Hg. The laparoscope is inserted and upper abdominal contents are visualized. The patient is placed in 20° to 30° Trendelenburg position for visualization of the pelvic structures. Additional sheaths are placed under laparoscopic guidance. Two 5-mm sheaths are placed approximately 3 to 4 cm medial to and slightly above the level of the anterior superior iliac spines. The inferior epigastric vessels should be avoided when these sheaths are being placed. Additional 10-mm sheath is placed in the suprapubic location.

The bowel is manipulated out of the pelvis with atraumatic forceps. The course of every pelvic ureter is visualized through the medial leaf of the broad ligament, and its position is verified during each portion of the procedure.

The uterus was placed on lateral traction (with the help of uterine manipulator), and the round ligament on each side was elevated and divided with the endoscopic scissors using monopolar electrocautery or with clip applier (Fig. 1). The peritoneum was opened lateral to the fallopian tube and infundibulopelvic ligament, and ovarian vessels were controlled with endoscopic scissors with monopolar cautery or with ligature (Fig. 2). In majority of cases salpingo-oophorectomy was performed.

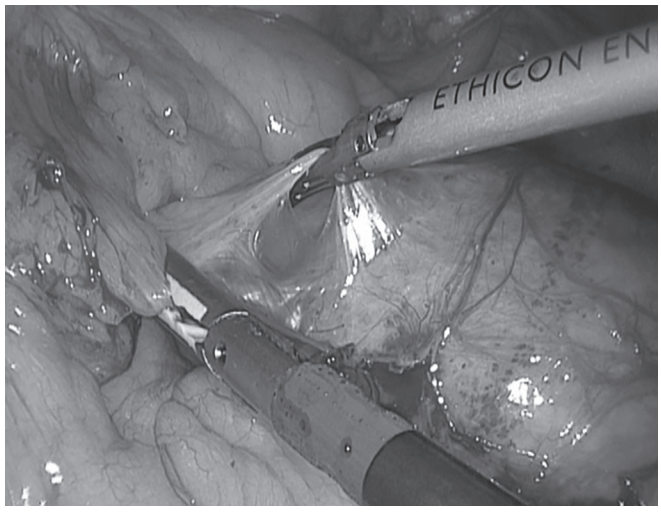


Fig. 1: Using uterine manipulator, the left round ligament is exposed and divided with clip applier or endoscopic scissors with monopolar cautery

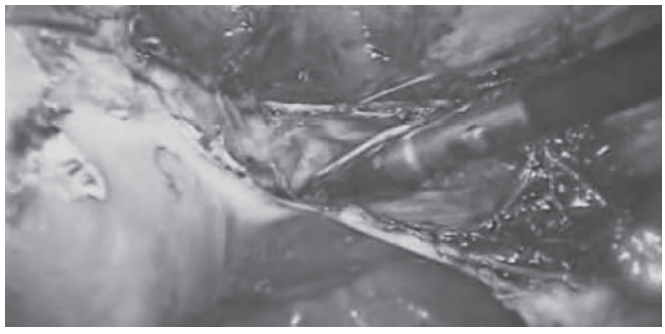


Fig. 2: Control of the infundibulopelvic ligament with the ligature

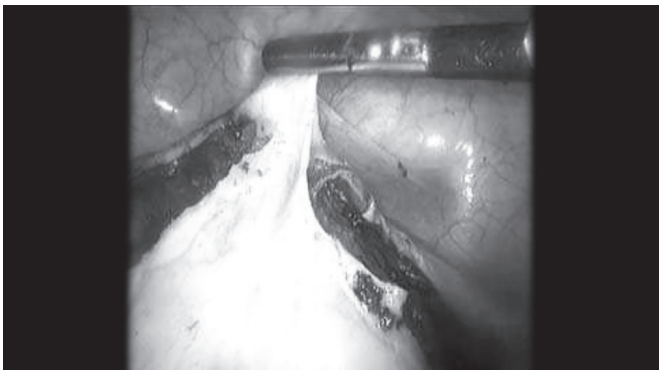


Fig. 3: An incision is made with scissors in the anterior vesico-uterine peritoneum

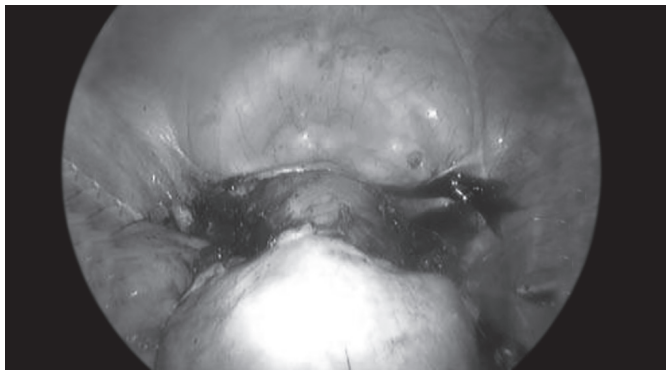


Fig. 4: The bladder is dissected away from the anterior cervix by sharp dissection

A window was created in the broad ligament with endoscopic scissors above the level of the ureter, extending from the infundibulopelvic ligament to the uterine vessels which are controlled with clip applier or ligature.

An incision was made with scissors in the anterior vesicouterine peritoneum. The bladder was pushed away from the anterior cervix by sharp dissection (Figs 3 and 4). Posterior peritoneum was incised by diathermy and uterosacral ligament was transected.

The vaginal phase consists of posterior colpotomy, followed by clamping, cutting, and suture-ligating the remaining paracervical tissues. The uterine vessels are sought and controlled. After completing the vaginal phase, the uterus is removed vaginally (Fig. 5). After removal of uterus, laparoscopic view to assure hemostasis was done (Fig. 6).

Group 2: Hand-assisted laparoscopic hysterectomy

The procedure is like group 1, but the intra-abdominal hand does most of the retracting action and also tactile sensation of the ureters. After freeing the whole uterus, the hand device is removed and the vagina is incised and the specimen is retrieved through the abdomen (Figs 7 and 8). The vaginal stump is closed with continuous vicryl sutures. Closure of LAP DISC wound

Fig. 5: Vaginal phase of posterior colpotomy and uterus is removed vaginally

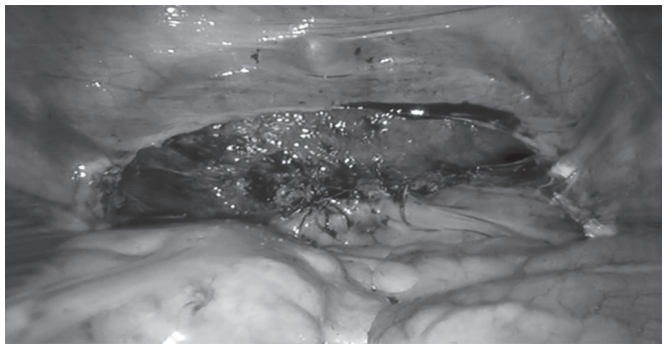
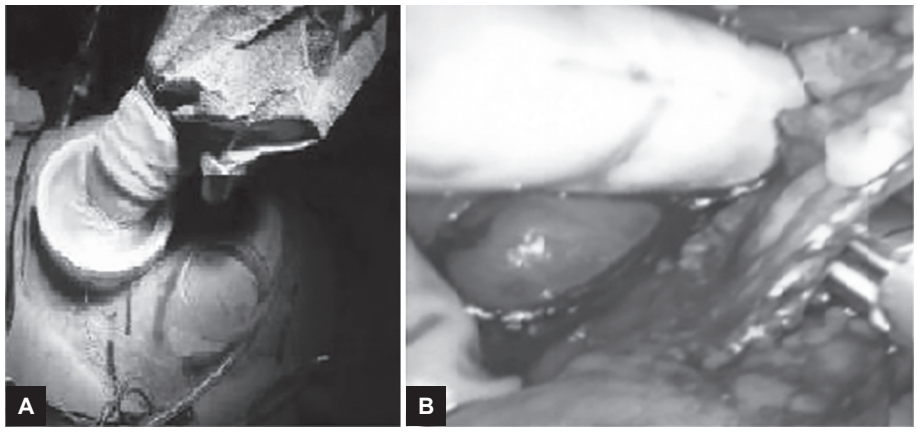


Fig. 6: After removal of uterus, laparoscopic view to assure hemostasis

Figs 7A and B: (A) Incision made in the pubic area to insert the LAB DISC; and (B) insertion of the LAB DISC



Figs 8A and B: (A) Hand-assisted technique at the moment of uterine artery control; and (B) control of the uterine artery

in two layers first the rectus sheath by vicryl 1-0 then skin and a pneumoperitoneum is re-created to confirm homeostasis and re-check for peristalsis of the ureters.

RESULTS

From August 2010 to March 2013, 41 consecutive patients fell within the criteria of the study. According to the date of admission, every patient was given an ordinal number. Patients with odd number were scheduled to have LAVH, and those with even numbers were scheduled to have HALH.

In our study the clinical characteristics of the 41 patients were similar as regards follow-up duration, age, parity, and uterine size (Table 1). The indications for hysterectomy among the study groups were nearly similar with uterine fibroids, and endometrial carcinoma comprised 78% of indications in both groups with no statistically significant difference (Table 2).

The mean operative time of HALH was insignificantly shorter than that of LAVH (123.50 *vs* 131.67 min respectively) (Table 3). There was a significant decline in the operative time with progress of the study (160–105 min in the first group and 190 to 95 min in the second group) (Graph 1).

Table 1: The clinical characteristics of the 61 patients

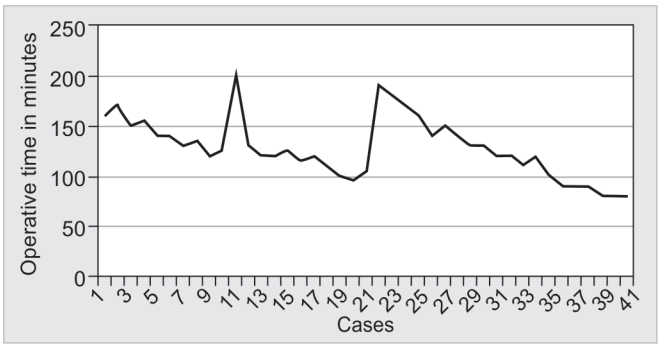
Items	*Group 1: LAVH*	*Group 2: HALH*	*Total*	*p-value*
Number	21	20	41	
Follow-up (months)	20.71	20.90	20.78	0.959
Mean age ± SD (years)	48.52 ± 7.55	52.10 ± 10.71	48.66 ± 8.54	0.222
Mean Parity ± SD	3.14 ± 1.15	2.95 ± 1.15	3.15 ± 1.20	0.594
The largest diameter of uterus (cm)	9.62 ± 1.72	9.85 ± 1.50	9.81 ± 1.70	0.649

LAVH: Laparoscopic-assisted vaginal hysterectomy; HALH: Hand-assisted laparoscopic hysterectomy; SD: Standard deviation

Table 2: The indications for hysterectomy among the study groups

	Study groups		
Items	*Group 1: LAVH*	*Group 2: HALH*	*Total*
Total number	21	20	41
Uterine fibroid	11 (52.5%)	8 (40%)	19 (46.4%)
Endometrial carcinoma	4 (19%)	9 (45%)	13 (31.7%)
Ovarian cancer	4 (19%)	2 (10%)	6 (14.6%)
Cervical carcinoma	2 (9.5%)	1 (5%)	3 (7.3%)

LAVH: Laparoscopic-assisted vaginal hysterectomy; HALH: Hand-assisted laparoscopic hysterectomy



Graph 1: The operative time for hysterectomy among laparoscopic-assisted vaginal hysterectomy study group

Table 3: The operative time for hysterectomy among the study groups

	Group 1: LAVH	*Group 2: HALH*	*p-value*
Number	21	20	
Mean time ± SD (min)	131.67 ± 24.92	123.50 ± 34.22	0.386
Mean time in first 10 cases (min)	142.50 ± 16.3	151.00 ± 23.31	0.426
Mean time in last 10 cases (min)	121.82 ± 28.04	96.00 ± 15.78	0.058*

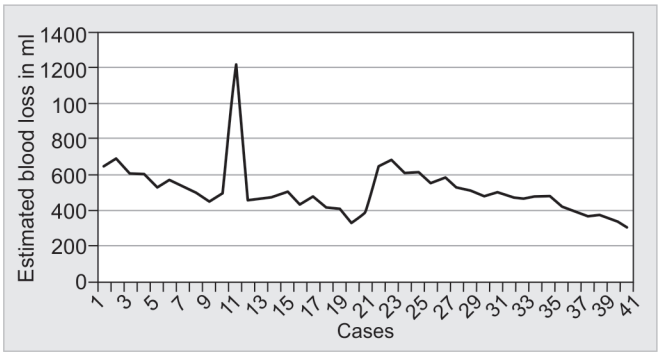
*Significant; LAVH: Laparoscopic-assisted vaginal hysterectomy; HALH: Hand-assisted laparoscopic hysterectomy

The need for blood transfusion was higher in the LAVH group, but the difference is not statistically significant (Table 4; Graph 2). We found no significant relation

Table 4: Estimated blood loss (mL), blood transfusion (packed RBC units), IV fluids (mL), and Hb reduction (gm/dL)

Items	*Group 1: LAVH*	*Group 2: HALH*	*p-value*
Number	21	20	
Mean blood loss (mL)	532.62 ± 175.80	490.75 ± 100.45	0.358
Mean blood transfusion (packed RBC units)	2.10 ± 0.83	1.90 ± 0.64	0.406
Mean IV fluids (mL)	2785.71 ± 845.15	2925.00 ± 19.99	0.531
Hb reduction (gm/dL)	1.34 ± 0.37	1.15 ± 0.21	0.055

RBC: Red blood cells; IV: Intravenous; Hb: Hemoglobin; LAVH: Laparoscopic-assisted vaginal hysterectomy; HALH: Hand-assisted laparoscopic hysterectomy



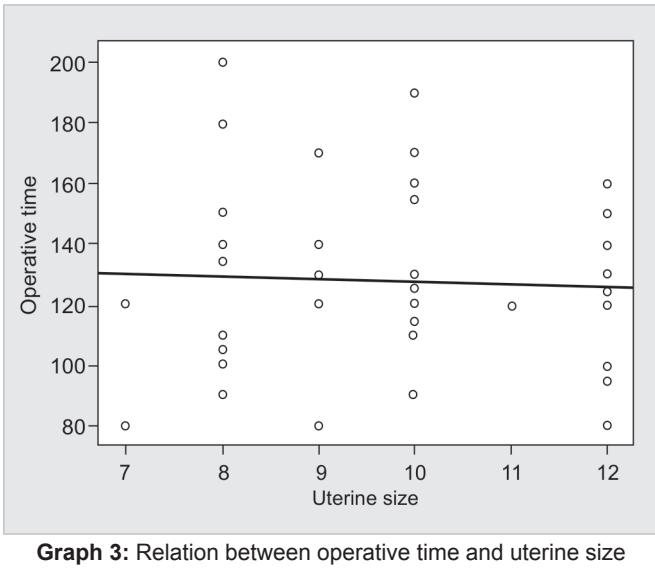
Graph 2: Blood loss among successive laparoscopic operations: as the study continues, there is a progressive decrease of the estimated blood loss

between uterine size and operative time and estimated blood loss. On the other hand, both time to begin ambulation and to regain daily activities are strongly related to operative time (p = 0.001, p = 0.006 respectively) (Table 5; Graph 3 to 5).

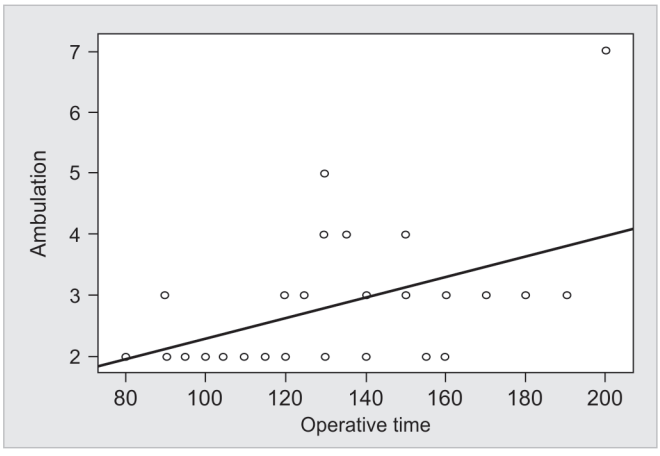
Table 5: Comparison between operative time and blood loss against uterine size, ambulation, and time to regain daily activities

Items	*p- and r-value*	*Operative time*	*Estimated blood loss*
Uterine size (cm)	r-value	0.050	0.100
	p-value	0.755	0.535
Ambulation (days)	r-value	0.500	0.684
	p-value	0.001*	0.000*
Regaining daily activities	r-value	0.424	0.609
	p-value	0.006*	0.000*

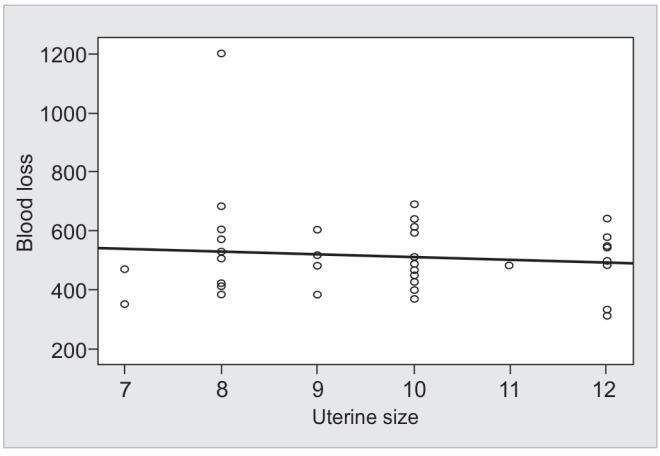
*Significant



Graph 3: Relation between operative time and uterine size



Graph 4: Relation between operative time and ambulation



Graph 5: Relation between blood loss and uterine size

In our study, two cases (9.5%) of the LAVH group needed laparotomy: To control bleeding in one case and to repair bladder injury in the other. No difficulty was met in delivering the uterus in any case in both groups. We did not do any morcellation for the specimens. No bowel or ureteric injuries occurred. No conversion was need in the HALH group (Table 6).

Mean hospital stay in the HALH group was significantly shorter than the LAVH group (3.45 *vs* 4.57 respectively; p = 0.007) (Table 7).

Postoperative complications included fever in five cases (12.2%): Four in the LAVH (due to urinary tract infection in three cases and wound infection in one case [this was the case that had laparotomy to control

Table 6: Intraoperative complications

Items	Group 1: LAVH	Group 2: HALH	Total	p-value
Number	21	20	41	
Anesthetic problems	0	0	0	
Intraoperative bleeding	1 (4.8%)	0	1 (2.4%)	0.323
Bladder injury	2 (9.5%)	0	2 (4.9%)	0.157
Ureteric injury	0	0	0	—
Bowel injury	0	0	0	—
Vascular injury	0	0	0	—
Conversion	2 (9.5%)	0	2 (4.9%)	0.157

LAVH: Laparoscopic-assisted vaginal hysterectomy; HALH: Hand-assisted laparoscopic hysterectomy

Table 7: Early postoperative findings

Items	Group 1: LAVH	Group 2: HALH	p-value
Number	21	20	
Mean postoperative analgesic consumption (75 mg Diclofenac Na)	11.24 ± 0.37	8.90 ± 1.89	0.010*
Mean flatulence relief time (hours)	27.81 ± 12.62	28.50 ± 4.10	0.814
Mean ambulation (nurse shifts)	3.00 ± 1.22	2.50 ± 0.61	0.108
Mean hospital stay (days)	4.57 ± 1.50	3.45 ± 0.94	0.007*

*Significant; LAVH: Laparoscopic-assisted vaginal hysterectomy; HALH: Hand-assisted laparoscopic hysterectomy

bleeding]) and one case in the HALH group due to wound infection (Table 8).

No significant difference was found between both groups as regards resumption of ordinary daily activities. But the mean duration of resumption of coital activities (if there were) was significantly lower in the HALH group (47.67 days) than in the LAVH group (58.00 days) (Table 9).

Table 8: Early postoperative complications

Items	Group 1: LAVH	Group 2: HALH	Total	p-value
Number	21	20	41	
Fever	4 (19.0%)	1 (5.0%)	5 (12.2%)	0.169
Wound infection	1 (4.8%)	1 (5.0%)	2 (4.9%)	0.972
Urinary tract infection	3 (14.3%)	0	3 (7.3%)	0.079
Hematomas	0	0	0	—
Deep venous thrombosis	0	0	0	—
Revision/ secondary studies	0	0	0	—

LAVH: Laparoscopic-assisted vaginal hysterectomy; HALH: Hand-assisted laparoscopic hysterectomy

Table 9: Late postoperative findings

	Group 1: LAVH	Group 2: HALH	p-value
Number	21	20	
Mean time for regaining daily activities (days)	25.00 ± 12.35	23.25 ± 5.45	0.564
Mean time for regaining coital activities (days) in sexually active cases	15† 58.00 ± 13.73	15† 47.67 ± 7.29	0.018*

†This number represents only cases who are sexually active
*Significant; LAVH: Laparoscopic-assisted vaginal hysterectomy; HALH: Hand-assisted laparoscopic hysterectomy

Late Postoperative Complications

Wo cases in the first group were readmitted, one for repair of vesicovaginal fistula and the other for repair of incisional hernia (after laparotomy to control bleeding). No cases were readmitted in the second group. No case had a recurrence until the end of the study (mean follow-up period was 24 months, the highest is 36 months), as shown in Table 10.

Our study found that hand piece in laparoscopic hysterectomy allows for tactile sensation, easy specimen retrieval through hand-port site, rapid control of bleeding by manual pressure, improved depth perception, and shortened learning curve. It avoids conversion to open approach and reduces operative time. On the contrary, the hand piece in laparoscopic hysterectomy has some drawbacks as hand encroaches upon intra-abdominal working space, requires large incision, and device-dependent air leak was reported frequently. It is also ergonomically unfavorable, leading to shoulder and forearm fatigue and strain. It also increases the costs of the operation (Table 11).

Table 10: Late postoperative complications

Items	Group 1: LAVH	Group 2: HALH	Total	p-value
Number	21	20	41	
Vesicovaginal fistula	1	0	1	0.323
Incisional hernia	0	0	1	0.323
Readmission	1	0	2	0.927

LAVH: Laparoscopic-assisted vaginal hysterectomy; HALH: Hand-assisted laparoscopic hysterectomy

DISCUSSION

In most studies about laparoscopic hysterectomy, dysfunctional uterine bleeding is a major indication. This is different from our study which is restricted to cases with tumors. In our study, uterine fibroids and endometrial carcinoma comprised 78% of indications in both groups.

Our series of LAVH with mean operative time of 131.5 min is comparable with that of other studies: Ikram et al[10] (178.0 min); Park et al[11] (253.8 min); Hong et al[12]

Table 11: Technical difference between LAVH and HALH

Items	*Group 1: LAVH*	*Group 2: HALH*
Incisions.	Only small stab incisions for ports	A 7 cm incision beside the ordinary ports
Incisional hernia	0	0
Working space	More working space	The hand inside the abdomen encroaches on the working space
Device-dependent air leakage	Rare	Occurs more
Specimen retrieval	Difficult	Easier
Control of bleeding	Slower	Rapid
Depth perception	Absent	Present
Conversion to open approach	2	0
Operative time	Longer	Shorter
Cost	Less	Higher

LAVH: Laparoscopic-assisted vaginal hysterectomy; HALH: Hand-assisted laparoscopic hysterectomy

(270 min); Ding et al[13] (120 min); Twijnstra et al[14] (144 min); Shin et al[15] (112.5 min); and Song et al[16] (102 min).

Estimated blood loss, the need for blood transfusion, and haemoglobin reduction were higher in the LAVH group, but the difference is not statistically significant. Mean estimated blood loss in the LAVH group was 532.62 mL, which is higher than other studies: Ikram et al[10] (105.13 mL); Park et al[11] (433.6 mL); Hong et al[12] (500 mL); Ding et al[13] (200 mL); Twijnstra et al[14] (457 mL); Soliman et al[17] (517.5 mL); and Song et al[16] (314 mL).

In our study, there was no relationship between the uterine size and the operative time or the rate of complications. But our study cannot efficiently address this issue because our patient group was selected with avoidance of relatively large uteri. In our institution, we are not familiar with morcellation because most of our patients have malignant or potentially malignant conditions.

Shiota et al[18] compared the surgical results (blood loss, operative time, rates of conversion to laparotomy, intra- and postoperative complications) among nine groups classified by uterine weight. Statistically significant differences in surgical outcomes were found between the group with a uterine weight ≥800 gm and the other groups. So when the uterine weight was ≥800 gm, total abdominal hysterectomy was more appropriate because significant blood loss and/or complications would be expected during LAVH. A removed uterus weighing 800 gm is reportedly equivalent to a preoperative uterine size of approximately 12 cm. Therefore, LAVH may be safely indicated for patients with a uterine size ≤12 cm (approximately equivalent to the uterine size at 16 weeks' gestation).[18]

We depended on the findings of Shiota et al[18] when we were planning for our study, so we chose 12 cm as a cutting point for the size of the uterus or adnexa to be excluded from the study. In the future we are planning to study laparoscopic hysterectomy on larger uteri.

The reason for converting laparoscopic hysterectomy to the conventional abdominal approach was uncontrollable bleeding or bladder injury. As reported in other studies, BMI and uterus weight are confirmed to be independent risk factors for conversion.[19]

Hospital stay in the HALH group was shorter (3.45 days) than in the LAVH group (4.57 days). This difference was statistically significant ($p = 0.007$). Duration of hospital stay in our study is comparable to that of Ding et al[13] (5 days), Soliman et al[17] (4.5 days) and Shin et al[15] (3.79 days). Asian, especially Korean, studies reported longer durations of hospital stay: Hong et al[12] (7 days) and Park et al[11] (10 days).

We also found no statistically significant difference between both groups as regards resumption of ordinary daily activities (mean time is 24 days). But the mean duration of resumption of coital activities (if there were) was significantly lower in the HALH group (47.67 days) compared with the LAVH group (58.00 days). Yi et al,[20] in a meta-analysis, found this period to vary between 21 and 30 days (mean is 25 days).

For all malignant cases in the study, there were no residual or recurrent tumors. The relatively small number and the short interval of follow-up make this study inappropriate to discuss the effect of various laparoscopic approaches on the oncologic aspects.

SUMMARY AND CONCLUSION

Laparoscopic-assisted vaginal hysterectomy has become a popular alternative to abdominal hysterectomy in cases that are difficult to manage via vaginal route alone.

Hand-assisted laparoscopic surgery was first described in the early 1990s as a surgical method designed to facilitate the performance of challenging laparoscopic procedures while maintaining the advantages of a minimally invasive approach.

Our present study aims to compare between LAVH and laparoscopic HALH. We included 41 sequential patients scheduled for hysterectomy at OCMU from August 2010 to March 2013. They were divided randomly (patient by patient) into two groups.

The clinical characteristics of the 41 patients were similar as regards follow-up duration, age, parity, and uterine size. The indications for hysterectomy among the study groups were nearly similar. No statistically significant difference was found between the two groups in operative time, which decreased progressively for

both groups but more in the second group. Operative blood loss was higher in the LAVH group. Two cases in the LAVH group were converted to laparotomy to control bleeding and to repair a urinary bladder tear. The HALH group showed less analgesic consumption, earlier ambulation, shorter hospital stay, and earlier regain of daily and coital activities. On the contrary, the HALH group had much more direct costs.

KEY MESSAGES

Hand-assisted laparoscopic technique was successfully developed and manual access to the laparoscopic field facilitated completion of an otherwise minimally invasive procedure.

We demonstrated that HALH is technically feasible, and in selected cases may provide an alternative to conventional techniques of hysterectomy.

Modifications in the technique that reduce surgical time would be beneficial and careful case selection and preparation is important for a successful outcome.

In our study the direct cost of HALH was much more than laparoscopic hysterectomy, because the LAP DISC® alone costs about £850. So we recommend its usage in patients with large uteri as the indirect costs of conventional laparotomy may exceed the direct costs of hand-assisted surgery.

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