SCIENTIFIC PAPER

The Role of Hand Assist Laparoscopic Surgery (HALS) in Pelvic Surgery for Nonmalignant Disease

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ABSTRACT

Objective: Hand assist laparoscopic surgery (HALS) is a surgical modality rarely used in benign gynecology. We analyzed nonmalignant pelvic disorders that utilized HALS to see whether there is any benefit over standard laparotomy.

Methods: A case control chart review identified patients who underwent HALS for a variety of benign gynecological conditions from 2004 through 2007. Cases were then compared with a control group of all the patients who underwent similar procedures for the same diagnosis via laparotomy (ELAP) in our center within the same time period. The groups were comparable with respect to age, BMI, and surgical indication.

Results: Twenty-nine patients were analyzed: 12 cases (HALS) and 17 controls (ELAP). Each group was broken up into 2 subsets: Group A, older patients who underwent surgery for pelvic organ prolapse or diverticulitis with adnexectomy and Group B, younger patients who underwent surgery for pelvic pain, endometriosis, or both. Hospital stay in Group B was statistically lower in the HALS cases vs. the ELAP controls, (2.9 vs. 5.4 days, P=0.04). All HALS and ELAP patients were then analyzed for overall trends. HALS cases had shorter hospitalization than ELAP controls had (3.3 vs 4.5 days, P=0.035). Estimated blood loss was also less overall in the HALS cases vs. the ELAP controls (175 vs 355.9 mL, P=0.021). There were 2 adverse outcomes reported in Group A of the HALS cases. These 2 patients experienced postoperative hernias though the hand-assist port-site incision.

Conclusion: Compared with laparotomy, overall, HALS offers the advantage of decreased hospitalization and decreased intraoperative blood loss. Postoperative hernias through the HA port site may be a potential problem with this technique.

Key Words: Hand assist laparoscopy, Pelvic surgery, Pelvic pain.

INTRODUCTION

Gynecologists have long discussed the benefits of laparoscopic surgery including shorter hospital stay, decreased postoperative pain, improved cosmesis, and faster return to normal activities. Occasionally, situations arise that create technical challenges even for skilled laparoscopists. Hand assist laparoscopic surgery (HALS) was developed in the early 1990s to prevent conversion from minimally invasive surgery to an open procedure.[1] HALS allows for the placement of the surgeon's nondominant hand through a hand-port device while maintaining pneumoperitoneum **(Figure 1)**. The intraabdominal hand works in conjunction with the traditional laparoscopic instruments manipulated by the surgeon's dominant hand. HALS essentially combines the superior visualization provided by the laparoscope with the tactile sensation of an open procedure. It allows for blunt dissection, superior hemostasis, organ retraction, and avoids the necessity for morcellation of solid organs. Published data[2–4] in the general surgery literature demonstrates that HALS is a safe and valid surgical approach for colectomies, splenectomies, and nephrectomies. When compared with traditional laparotomy, these studies report decreased blood loss, length of hospital stay, morbidity, and a faster recovery period.

Several gynecologic studies have looked at HALS in the evaluation of adnexal masses and gynecologic cancers.[5–9] These reports have concluded that the HALS approach provides thorough evaluation of peritoneal and retroper-

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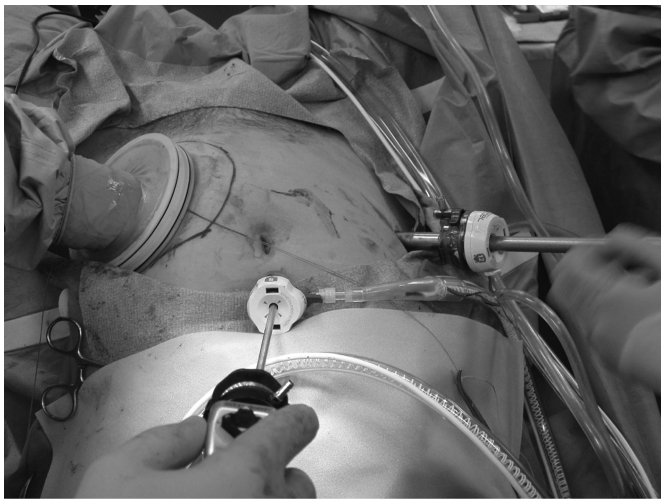

Figure 1. HALS Setup. 5-mm laparoscope placed just above (or into) umbilicus. Hand-assist port in left lower quadrant with surgeon's nondominant (left) hand placed in port with iris valve turned to maintain pneumoperitoneum. Right lower quadrant port with traditional 11-mm trocar is controlled by the surgeon's dominant (right) hand or an assistant.

itoneal structures as well as cytoreduction while maintaining the benefits of minimally invasive surgery. Pelosi[11] published case reports about the use of HALS for complex hysterectomy in 1999. However, studies using HALS in benign gynecology are scarce.[10,11] Our goal was to review nonmalignant pelvic surgery cases where HALS was used at our institution to see whether there is any benefit over standard laparotomy. We also hope to present some situations that gynecologists encounter where HALS may be a viable minimally invasive alternative to converting to laparotomy.

METHODS

After obtaining IRB approval, a records search in a pelvic surgery referral center identified 14 patients who underwent a HALS procedure between 2004 and 2007. Two patients who received HALS via a midline vertical incision were excluded to maintain a uniform comparison. Record review of the remaining 12 HALS patients identified the indication and the operative procedures performed. A second review then identified a control group of 17 patients who underwent similar procedures for the same indication via traditional open laparotomy during the same period.

Information about patient demographics, surgical indications, procedures, estimated blood loss, postoperative drop in hematocrit, operative time, average pain scores, length of hospital stay, and complications were abstracted from each chart. Pain scores were patient reported and nurse recorded using a Visual Analog Scale (VAS) pain scale. Data were expressed using means with standard deviations. Univariate analysis used the Mann-Whitney U Test and Fisher's Exact Test with significance set at $P<0.05$.

Two subgroups of patients emerged from both the study group (HALS) and the controls (ELAP) based on age and the underlying disease process. The first subset of patients (Group A) comprised older patients whose indication for surgery was pelvic organ prolapse or diverticular disease with adnexectomy. The indication for the second, younger subset of patients (Group B) was pelvic pain secondary to endometriosis, adhesions, or both of these **(Tables 1 and 2)**. In addition to the overall HALS and ELAP group analysis, Groups A and B were analyzed separately **(Table 3)**.

Surgical Technique

All procedures were performed by a combination of 1 to 2 of 4 attending surgeons including one minimally invasive gynecologist, one urogynecologist, one minimally invasive general surgeon, and one colorectal surgeon, and a gynecology laparoscopic fellow was always present. Each HALS patient was placed in a dorsal lithotomy position in Allen stirrups. Every HALS case started out as a laparoscopic surgery with a 5-mm bladeless Xcel trocar (Ethicon Endo-Surgery, Inc., Cincinnati, Ohio) placed directly in or just above the umbilicus and 2 lateral 11-mm bladeless Excel trocars in each of the lateral lower quadrants. In the majority of cases, the decision to place a hand-assist port was made after the case was attempted laparoscopically. Usually dense adhesions prevented the surgeon from continuing the case laparoscopically. After removing the left lower quadrant 11-mm port, a 5.5-cm to 7-cm left lower quadrant incision was made approximately 3 fingerbreadths above the anterior superior iliac spine, lateral to the rectus muscles, and the hand-assist port device (LAPDISC and Ethicon Endo-Surgery, USA) was inserted. The surgeon was then able to complete the surgery using standard laparoscopic techniques with the additional help of the intraperitoneal hand.

RESULTS

Patient characteristics and outcomes of both HALS patients and ELAP patients (controls) are given in **Tables 3 and 4**. Statistical analysis is presented in **Table 5**.

Table 1.
Hand Assist Laparoscopy (HALS) Patients

Patient #	Group	Age (years)	Disease*	Surgery*	1° Surgeon	2° Surgeon	BMI*	OR Time (min)	EBL*	Drop in Hct* (mL)	Pain Score (VAS*)	Hospital Stay (days)	Complications
1	A	71	POP s/p TVH, SUI	HA Sacrocolpopexy/ Cysto/BSO/LOA/ TVTO/PR	Gyn	Uro/ Gyn	26	159	400	10.8	3.67	3	Port site hernia
2	A	71	POP s/p TVH	HA Sacrocolpopexy/ Cysto/Stents/BSO/ LOA	Gyn	Fellow	24	152	100	5.4	1.6	3	
3	A	61	POP/SUI s/p TAH/BSO	HA Sacrocolpopexy/ cysto/stents/BSO/ LOA/TVTO	Uro/ Gyn	Fellow	23	270	100	6.5	0	2	Port site hernia
4	A	70	Diverticulitis s/p TLH/BSO	HA Partial colectomy/ Colostomy/Cysto/ Stents/LOA	Gen Surg	Gyn	28	156	150	18.7	4.2	9	
5	A	53	Diverticulitis	HA Subtotal colectomy/LOA/LSO/ Core liver Bx	Gen Surg	Gyn	43	184	100	6	4.5	3	
6	B	36	Stage 4 endometriosis	HA LSO/Ureterolysis/ LOA/Cysto/Stent/ Sigmoidoscopy	Gyn	Gen Surg	23	151	150	5.8	3.6	1	
7	B	28	Frozen pelvis, s/p TAH, Multiple laparotomies, w/ B/L ovarian masses	HA BSO/LOA/ Ureterolysis/Cysto/ Stents/Bowel resection	Gyn	Gen Surg	28	169	400	22.5	2.45	4	2 U PRBCs
8	B	28	Rectal endometriosis	HA LAR Colon Resection/Cysto/ Stents	Gen Surg	Gyn	25	174	50	1	0.68	3	
9	B	29	Crohn's, Pelvic Pain	HA LAR Sigmoid colectomy/Cysto/ Stents/LSO	Gen Surg	Gyn	33	153	50	8	5.1	2	
10	B	34	Ileus/SBO/h/o Multiple surgeries	HA LOA/Cysto/Stents/ Right ureterolysis	Gen Surg	Gyn	19	199	150	2.6	2.1	7	
11	B	29	Endo/Ovarian remnant	HA B/L Excision of ovarian masses/LOA/ Cysto/Stents	Gyn	Gen Surg	22	95	150	1	3.7	2	
12	B	39	Stage 4 Endo/ Fibroids/ Menometrorrhagia	HA SCH/LSO/LOA/ Cysto	Gyn	Fellow	50	115	300	3	1.8	1	

*BMI=body mass index; BSO=bilateral salpingo-oophorectomy; Bx=biopsy; Cysto=cystoscopy; EBL=estimated blood loss; Endo=endometriosis; HA=hand assist; Hct=Hematocrit; LAR=left anterior (colon) resection; LOA=lysis of adhesions; LSO=left salpingo-oophorectomy; POP=pelvic organ prolapsed; PR=posterior repair; SBO=small bowel obstruction; SCH=supracervical hysterectomy; SUI=stress urinary incontinence; Surg=surgery; TAH=total abdominal hysterectomy; TVTO=tension free vaginal taping obturator; VAS=visual analog scale.

Table 2.
Exploratory Laparotomy (ELAP) Patients (Controls)

Patient #	Group	Age (years)	Disease*	Surgery*	1° Surgeon	2° Surgeon	BMI*	OR time (min)	EBL	Drop in Hct* (mL)	Pain Score (VAS*)	Hospital Stay (days)	Complications
1	A	74	POP/Procidentia/ Cystocele	TAH/BSO/Abd. Sacral Colpopexy/ Burch/Cysto/Stents	Gyn	Fellow	29	99	100	5.9	4.67	3	
2	A	77	Vaginal vault prolapse/ Cystocele/ Rectocele/ SUI	Abd Sacral Colpopexy/Burch/enterolysis/AR/ PR/Cysto / Stents	Gyn	Fellow	23	109	100	5.1	4	3	
3	A	62	Vaginal vault prolapse /SUI/Cystocele/ Frequency	TAH/BSO/Abd Sacral Colpopexy/ Ureterolysis/Burch /AR/ Cysto	Gyn	Fellow	20	123	200	0.5	0.83	3	
4	A	66	POP s/p TAH/BSO/ Delayed defecation	Abd Sacral Colpopexy /Partial vaginectomy/Sigmoid resection/Rectopexy/Excisional bx of anal lesion	Uro/ Gyn	Colorectal	24	324	300	7.2	0.86	6	
5	A	69	POP/Delayed defecation	Partial Vaginectomy/Abd sacro colpopexy/cysto/ LOA/Rectopexy	Uro/ Gyn	Colorectal	31	195	250	3.7	1.81	4	
6	A	45	POP/OAB/Urge incontinence	Abd Sacral Colopexy/Partial vaginectomy/cysto/Sigmoid Resection/Rectopexy	Uro/ Gyn	Colorectal	24	216	200	3.7	3.2	4	
7	A	42	POP	TAH/Abd sacral colpopexy	Gyn	Fellow	37	219	500	9.4	2	3	
8	A	58	POP/Urinary frequency/Ovarian cyst	Abd sacrocolpopexy/LSO/R salpingectomy /cysto/ Transanal resection of rectocele	Uro/ Gyn	Colorectal	24	243	550	4.9	3.6	3	
9	A	66	POP	TAH/BSO/Abd Sacrocolpopexy/Partial vaginectomy/Rectocele repair w/ perineorrhaphy	Uro/ Gyn	Fellow	32	318	450	9.5	1.4	4	
10	B	31	Pelvic pain/Rectal endometriosis	LSC converted to ELAP/LOA/LAR/ Cysto/Stents	Gyn	Gen Surg	22	128	100	3.9	3.53	4	
11	B	44	Ovarian remnant/Endometriosis	Dx LSC/ELAP/LOA/LAR/R Ovarian Remnant/Cysto/Stents	Gyn	Gen Surg	21	133	300	7.3	0.78	6	
12	B	43	Rectal endometriosis	Dx LSC/ELAP/LAR/BSO/Trachelectomy	Gen Surg	Gyn	31	85	150	2.9	1.84	4	
13	B	36	Ovarian remnant/ Multiple laparotomies	ELAP/LOA/LSO/Cysto/Stents	Gyn	Gen Surg	28	125	200	0.8	0.62	10	
14	B	37	Stage 4 endometriosis	TAH/BSO/Appendectomy/LOA/ cysto	Gyn	Fellow	27	89	450	10.9	1.38	2	
15	B	41	Stage 4 endometriosis	TAH/BSO/Cysto/Stents/LOA/ Ureterolysis/Ileocolic Resection/LAR/Sigmoidoscopy	Gyn	Gen Surg	23	232	1000	18.3	1.2	7	2 U PRBCs
16	B	27	Stage 4 endometriosis	ELAP/Appendectomy/LAR/LOA/R Ovarian cystectomy/Small bowel resection/Cysto/Stents	Gen Surg	Gyn	28	141	200	2.9	3.8	5	
17	B	31	Stage 4 endometriosis	TAH/BSO/Cysto/Stents/Excision of rectal endometriosis	Gyn	Gen Surg	29	253	1000	5.4	2.1	5	2 U PRBCs

*BMI=body mass index; BSO=bilateral salpingo-oophorectomy; Bx=biopsy; Cysto=cystoscopy; EBL=estimated blood loss; Endo=endometriosis; HA=hand assist; Hct=Hematocrit; LAR=left anterior (colon) resection; LOA=lysis of adhesions; LSO=left salpingo-oophorectomy; POP=pelvic organ prolapsed; PR=posterior repair; SBO=small bowel obstruction; SCH=supracervical hysterectomy; SUI=stress urinary incontinence; Surg=surgery; TAH=total abdominal hysterectomy; TVTO=tension free vaginal taping obturator; VAS=visual analog scale.

Table 3.
Statistical Analysis

Comparisons*	N	Age			BMI*			Duration of Surgery (min)			EBL*			Hct Drop (mL)			Post Op Pain Score (VAS*)			Hospital Stay (days)		
		Mean	*±SD*	*p Value*	*Mean*	*±SD*	*p Value*	*Mean*	*±SD*	*p Value*	*Mean*	*±SD*	*p Value*	*Mean*	*±SD*	*p Value*	*Mean*	*±SD*	*p Value*	*Mean*	*±SD*	*p Value*
All HALS Patients	12	46	18		28.7	9.2		165	43		175	123		7.6	6.7		2.7	1.6		3.3	2.4	
All ELAP Patients	17	50	16	0.36	26.9	4.6	0.93	178	78	0.97	356	281	0.021†	6	4.3	0.61	2.2	1.3	0.33	4.5	1.9	0.035†
Group A, HALS Patients	5	65	8		28.8	8.2		184	50		170	130		9.5	5.6		2.8	1.9		4	2.8	
Group B, HALS Patients	7	32	4	<0.001	28.6	11	0.97	151	36	0.2	179	129	0.91	6.3	7.6	0.44	2.7	1.4	0.43	2.9	2.1	0.44
Group A, HALS Patients	5	65	8		28.8	8.2		184	50		170	130		9.5	5.6		2.8	1.9		4	2.8	
Group A, ELAP Patients	9	62	12	0.64	27.1	5.4	0.84	205	84	0.64	294	169	0.12	5.5	2.9	0.1	2.5	1.4	0.64	3.7	1	0.37
Group B, HALS Patients	7	32	4		28.6	11		151	36		179	129		6.3	7.6		2.7	1.4		2.9	2.1	
Group B, ELAP Patients	8	36	6	0.15	26.6	3.7	0.9	148	62	0.49	425	370	0.01	6.6	5.7	0.73	1.9	1.2	0.27	5.4	2.4	0.04†

*BMI=body mass index; EBL=estimated blood loss; ELAP= exploratory laparotomy; HALS=hand assisted laparoscopic surgery; Hct=Hematocrit; VAS=visual analog scale.

Table 4.
Exploratory Laparotomy (ELAP) Patients (Controls)

Patient #	Group	Age (years)	Disease	Surgery	1° Surgeon	2° Surgeon	BMI*	OR Time (min)	EBL*	Drop in Hct (mL)	Pain Score (VAS)	Hospital Stay (days)	Complications
1	A	74	POP/Procidentia/ Cystocele	TAH/BSO/Abd sacrocolpopexy/Burch/Cysto/ Stents	Gyn	Fellow	29	99	100	5.9	4.67	3	
2	A	77	Vaginal vault prolapse/ Cystocele/ Rectocele/SUI	Abd Sacral Colpopexy/Burch/ enterolysis/AR/PR/Cysto / Stent	Gyn	Fellow	23	109	100	5.1	4	3	
3	A	62	Vaginal vault prolapse /SUI/ Cystocele/ Frequency	TAH/BSO/Abd Sacral Colpopexy/ Ureterolysis/Burch /AR/ cysto	Gyn	Fellow	20	123	200	0.5	0.83	3	
4	A	66	POP s/p TAH/ BSO/Delayed defecation	Abd Sacral Colpopexy/Partial vaginectomy/Sigmoid resection/Rectopexy/ Excisional bx of anal lesion	Uro/ Gyn	Colorectal	24	324	300	7.2	0.86	6	
5	A	69	POP/Delayed defecation	Partial Vaginectomy/Abd sacrocolpopexy/cysto/ LOA/ Rectopexy	Uro/ Gyn	Colorectal	31	195	250	3.7	1.81	4	
6	A	45	POP/OAB/Urge incontinence	Abd Sacral Colpopexy/Partial vaginectomy/cysto/Sigmoid resection/Rectopexy	Uro/ Gyn	Colorectal	24	216	200	3.7	3.2	4	
7	A	42	POP	TAH/Abd Sacral Colpopexy	Gyn	Fellow	37	219	500	9.4	2	3	
8	A	58	POP/Urinary frequency/ Ovarian cyst	Abd Sacro Colpopexy/LSO/R Salpingectomy /cysto/ Transanal resection of rectocele	Uro/ Gyn	Colorectal	24	243	550	4.9	3.6	3	
9	A	66	POP	TAH/BSO/Abd Sacrocolpopexy/Partial vaginectomy/Rectocele repair w/ perineorrhaphy	Uro/ Gyn	Fellow	32	318	450	9.5	1.4	4	
10	B	31	Pelvic pain/Rectal endometriosis	LSC converted to ELAP/LOA/ LAR/Cysto/Stents	Gyn	Gen Surg	22	128	100	3.9	3.53	4	
11	B	44	Ovarian remnant/ endometriosis	Dx LSC/ELAP/LOA/LAR/R Ovarian remnant/Cysto/Stents	Gyn	Gen Surg	21	133	300	7.3	0.78	6	
12	B	43	Rectal endometriosis	Dx LSC/ELAP/LAR/BSO/ Trachelectomy	Gen Surg	Gyn	31	85	150	2.9	1.84	4	
13	B	36	Ovarian remnant/ Multiple laparotomies	ELAP/LOA/LSO/Cysto/Stents	Gyn	Gen Surg	28	125	200	0.8	0.62	10	
14	B	37	Stage 4 endometriosis	TAH/BSO/Appendectomy/ LOA/Cysto	Gyn	Fellow	27	89	450	10.9	1.38	2	

Table 4 continued on next page.

Table 4. (continued)
Exploratory Laparotomy (ELAP) Patients (Controls)

Patient #	Group	Age (years)	Disease	Surgery	1° Surgeon	2° Surgeon	BMI*	OR Time (min)	EBL*	Drop in Hct (mL)	Pain Score (VAS)	Hospital Stay (days)	Complications
15	B	41	Stage 4 endometriosis	TAH/BSO/cysto/stents/LOA/ Ureterolysis/Ileocolic resection/LAR/Sigmoidoscopy	Gyn	Gen Surg	23	232	1000	18.3	1.2	7	2 U PRBCs
16	B	27	Stage 4 endometriosis	ELAP/Appendectomy/LAR/ LOA/R Ovarian cystectomy/ Small bowel resection/Cysto/ Stents	Gen Surg	Gyn	28	141	200	2.9	3.8	5	
17	B	31	Stage 4 endometriosis	TAH/BSO/cysto/stents/Excision of rectal endometriosis	Gyn	Gen Surg	29	253	1000	5.4	2.1	5	2 U PRBCs

*BMI=body mass index; BSO=bilateral salpingo-oophorectomy; Bx=biopsy; Cysto=cystoscopy; EBL=estimated blood loss; Endo=endometriosis; HA=hand assist; Hct=Hematocrit; LAR=left anterior (colon) resection; LOA=lysis of adhesions; LSO=left salpingo-oophorectomy; POP=pelvic organ prolapsed; PR=posterior repair; SBO=small bowel obstruction; SCH=supracervical hysterectomy; SUI=stress urinary incontinence; Surg=surgery; TAH=total abdominal hysterectomy; TVTO=tension free vaginal taping obturator; VAS=visual analog scale.

HALS patients naturally fell into 2 groups based on age and underlying disease process. Patients in Group A (n=5) were older with a mean age of 65 years, and all had either pelvic organ prolapse or diverticular disease as their underlying disease. Patients in Group B (n=7) were younger with a mean age of 32 years, and all suffered from pelvic pain due to endometriosis, adhesions, or both. The mean ages of the 2 groups were statistically significant (P=0.001), and no overlap in the underlying disease process existed between the groups. All other comparisons between Group A HALS and Group B HALS patients were not significant.

The 2 surgical techniques, ELAP and HALS were compared first by analyzing Group A and Group B separately. As expected, comparison of ELAP patients in Group A and Group B showed differences in age and underlying disease process (data not shown). The indications and types of surgical procedures performed in each group were similar and are listed in **Tables 1 and 2**.

In Group A, 2 of the HALS cases were performed with the help of a general surgeon, and 4 of the ELAP cases were performed with the help of a colorectal specialist. There was no statistical difference in hospital stay, operative time, or average pain scores in the HALS cases when compared with the ELAP controls.

The majority of patients in Group B had undergone multiple surgeries in the past. Six of the 7 HALS cases were performed in conjunction with one general surgeon. The same general surgeon assisted in 7 of 8 of the ELAP cases. There was no difference in the postoperative drop in hematocrit, operative (OR) time, or average pain scores **(Table 3)**. The patients in Group B who underwent their surgery via HALS had less estimated blood loss (178.6 vs. 425.0 mL, P=0.01) than the ELAP controls had. The length of hospital stay in all HALS cases vs. all ELAP controls was significant (2.9 vs. 5.4 days, P=0.04). Complications in Group B included 1 HALS patient and 2 ELAP patients who required intraoperative blood transfusions of 2 units of packed red blood cells each.

Because age and the underlying disease process were the only significant differences between Group A HALS patients and Group B HALS patients, the 2 groups were combined for subsequent comparison with the ELAP (control) patients. When analyzed overall, the HALS patients had a shorter hospital stay (3.3 vs. 4.5 days, P=0.035) and less estimated blood loss (175.0 vs. 355.9 mL, P=0.021) than the ELAP controls had **(Table 3)**. No other differences reached significance.

Table 5.
Statistical Analysis

Comparisons	Age				BMI			Duration of Surgery			EBL			Hct Drop			Post OP Pain Score			Hospital Stay		
	N	*Mean*	*±SD*	*p value*	*Mean*	*±SD*	*p value*	*Mean*	*±SD*	*p value*	*Mean*	*±SD*	*p value*	*Mean*	*±SD*	*p value*	*Mean*	*±SD*	*p value*	*Mean*	*±SD*	*p value*
All HALS Patients	12	46	18		28.7	9.2		165	43		175	123		7.6	6.7		2.7	1.6		3.3	2.4	
All ELAP Patients	17	50	16	0.36	26.9	4.6	0.93	178	78	0.97	356	281	0.021*	6	4.3	0.61	2.2	1.3	0.33	4.5	1.9	0.035*
Group A, HALS Patients	5	65	8		28.8	8.2		184	50		170	130		9.5	5.6		2.8	1.9		4	2.8	
Group B, HALS Patients	7	32	4	<0.001	28.6	11	0.97	151	36	0.2	179	129	0.91	6.3	7.6	0.44	2.7	1.4	0.43	2.9	2.1	0.44
Group A, HALS Patients	5	65	8		28.8	8.2		184	50		170	130		9.5	5.6		2.8	1.9		4	2.8	
Group A, ELAP Patients	9	62	12	0.64	27.1	5.4	0.84	205	84	0.64	294	169	0.12	5.5	2.9	0.1	2.5	1.4	0.64	3.7	1	0.37
Group B, HALS Patients	7	32	4		28.6	11		151	36		179	129		6.3	7.6		2.7	1.4		2.9	2.1	
Group B, ELAP Patients	8	36	6	0.15	26.6	3.7	0.9	148	62	0.49	425	370	0.01	6.6	5.7	0.73	1.9	1.2	0.27	5.4	2.4	0.04*

Clinically significant adverse outcomes occurred in 2 Group A HALS patients who developed hernias through their HA port sites. The first patient had a history of asthma and had a coughing spell at home on postoperative day #3. She was later readmitted with a small bowel herniation through the hand-assist incision port site. A small bowel resection was performed. The second patient reported a bulge at her HALS incision site several months after the procedure. A CT of the abdomen and pelvis did not reveal herniation; however, the patient sought consultation with a general surgeon who reinforced the incision.

DISCUSSION

It is well known that gynecologists were the pioneers of laparoscopic surgery. However, due to the lack of familiarity with the procedure and a need to standardize the technique, most gynecologists have been slow to adopt HALS. This study highlights certain situations where HALS might be used as an alternative to converting to laparotomy. We suggest that HALS may actually be easier for the surgeon in certain incidences, including in obese patients with stage 4 endometriosis, obliteration of the cul de sac, and dense adhesions. While these cases may be impossible laparoscopically, by introducing a hand into the intraperitoneal cavity, the surgeon may be able to perform digital dissection while still benefiting from the superior visualization of the laparoscope. Laparotomy incisions in obese patients are wrought with difficulties and often visualization is poor when a surgeon is working in a deep pelvis. HALS allows the surgeon greater visualization, while the patient benefits from still having a minimally invasive procedure. The potential benefits of HALS may outweigh the potential disadvantages.

Another potential avenue for the HALS technique is in patients with pelvic organ prolapse. A minimally invasive approach would likely benefit many of these patients who tend to be older and who often present with more comorbidities than their younger counterparts. Furthermore, due to the complexity of the procedure, many surgeons are not able to complete sacral colpopexies laparoscopically. HALS may allow the surgeon the opportunity to offer a minimally invasive alternative to the traditional abdominal sacral colpopexy.

This study was limited in many ways due to its' retrospective nature, small number of patients, and lack of randomization. There was no statistical significance in operative times between ELAP and HALS cases. Operative times were no doubt influenced somewhat by the surgeon's experience. As gynecologists become more familiar with the HALS technique, operative times will likely decrease as the learning curve progresses for each surgeon. In addition to surgeon experience, the standardization of a HALS technique for gynecologists would also likely cut down on operative times.

The fact that the majority of the HALS cases in this study were performed in conjunction with a general or colorectal surgeon lends to the fact that in the world of benign gynecology, we are just learning this technique. HALS is proving promising in the oncologic realm. Spannuth et al[5] described in their ovarian cancer study removing ovarian masses that averaged approximately 11cm. As more gynecologists become familiar with this technique, it may be adopted and used in more benign gynecology cases.

This study also demonstrates that HALS provides the advantage of an approximately one-day decrease in duration of hospital stay and a small (180mL) decrease in intraoperative blood loss. Estimated blood loss is often difficult to quantify; therefore, we looked at the postoperative drop in hematocrit. The numbers may have been affected by the fact that all patients had preoperative bowel preps and then received IV hydration intra- and postoperatively. Three patients in the pelvic pain group (Group B) received intraoperative blood transfusions, one who underwent HALS and 2 who underwent ELAP. These blood transfusions obviously make the postoperative hematocrit levels inaccurate reflections of blood loss.

The reported pain scores were problematic in this retrospective study as well. Pain scores as recorded by the nursing staff using the VAS were not measured in a consistent manner or time frame in each patient. We were limited to the numbers recorded. A prospective study would definitely lead to a more accurate record of pain scores. The pain scores were also influenced by the patients' pain medication, which was variable throughout the study. The ELAP patients actually had slightly lower overall pain scores (2.2 ± 1.3 vs 2.7 ± 1.6, $P=0.33$), which was likely reflected by the fact that the majority of patients who had a laparotomy incision were given a PCA (patient controlled analgesia) pump postoperatively for at least 24 hours. HALS patients routinely were treated with IV and PO pain medications as needed postoperatively. Attempts were made to record postoperative pain medication consumption in both HALS cases and their ELAP controls. However, given the variability in the type of analgesics, routes of administration, and accuracy in the record of administration, it was not possible to use this parameter in this retrospective study.

The occurrence of 2 postoperative incisional hernias among the 12 HALS patients (incidence 17%) is concerning. This high incidence could be due to one or more of the following causes[1]: the left lower quadrant incision used in these 12 patients is an inherently weak incision site that is associated with a high postoperative hernia rate[2]; the incision was not properly closed[3]; these 2 patients had compromised fascia; and/or[4] these hernias are just an unfortunate chance occurrence. The incision sites were closed with 0 Vicryl in both cases. A delayed absorbable suture could be considered as a potential means to reduce this complication. Also, moving the port-assist device to a low midline transverse position may be another potential means to consider in reducing hernia formation.

It is evident that this small retrospective study has several limitations. However, the other purpose of this study was to introduce HALS into the world of benign gynecology and to highlight some possible situations where surgeons may use HALS as an alternative to laparotomy. Although prospective, larger studies are needed, as well as standardization of the technique, HALS appears to be a promising modality in the world of benign gynecology.

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