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. 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 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. These reports have concluded that the HALS approach provides thorough evaluation of peritoneal and retroperitoneal disease, improved visualization, and reduced blood loss. The role of HALS in the management of nonmalignant pelvic disorders has not been well studied. We analyzed nonmalignant pelvic disorders that utilized HALS to see whether there is any benefit over standard laparotomy.
ileal structures as well as cytoreduction while maintaining the benefits of minimally invasive surgery. Pelosi published case reports about the use of HALS for complex hysterectomy in 1999. However, studies using HALS in benign gynecology are scarce. 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 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.
| Patient # | Group | Age (years) | Disease* | Surgery* | 1st Surgeon | 2nd 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 | 150 | 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/Stents/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/BSO | 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 tape 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 Colpopexy/Partial cystectomy/cysto/SG 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/ISO/R salpingectomy /cysto/ Transanal resection of rectocele | Uro/ Gyn Colorectal | 24 | 214 | 550 | 49 | 3.6 | 3 |
| 9 A 66    | POP | TAH/BSO/Abd Sacrocolpopexy/Partial vaginectomy/Rectocele repair w/ perineorrhaphy | Uro/ Gyn | 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/Ovarian Remnant/Cysto/Stents | Gyn Gen Surg | 21 | 133 | 300 | 7.3 | 0.78 | 6 |
| 12 B 43   | Rectal endometriosis | Dx LSC/ELAP/LOA/BSO/Trachelectomy | Gen Surg | 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 | 10 |
| 15 B 41   | Stage 4 endometriosis | TAH/BSO/Cysto/Stents/LOA/ Ureterolysis/Ileocele 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 | 28 | 141 | 200 | 2.9 | 3.8 | 5 |
| 17 B 31   | Stage 4 endometriosis | TAH/BSO/Cysto/Stents/Excision of rectal endometriosis | 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; 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) |
|--------------|----|-----|------|---------------------------|------|---------------|--------------------------|---------------------|
| All HALS Patients | 12 | 46  | 18   | 28.7 9.2                  | 165  | 7.6 6.7       | 2.7 1.6                  | 3.3 2.4             |
| All ELAP Patients | 17 | 50  | 16   | 26.9 4.6                  | 178  | 6.3 4.3       | 2.7 2.1                  | 4.5 1.9             |
| Group A, HALS Patients | 5  | 65  | 8    | 28.8 8.2                  | 184  | 6.7 4.4       | 2.7 1.4                  | 4.4 2.8             |
| Group B, HALS Patients | 7  | 32  | 4    | 28.6 11.01                | 151  | 5.5 2.9       | 1.4 0.64                 | 3.7 1.0             |
| Group A, ELAP Patients | 9  | 62  | 12.64| 27.1 5.4 0.84            | 205  | 5.5 2.9       | 1.4 0.64                 | 3.7 1.0             |
| Group B, ELAP Patients | 7  | 32  | 4    | 28.6 11.01                | 151  | 5.5 2.9       | 1.4 0.64                 | 3.7 1.0             |

*BMI=body mass index; EBL=estimated blood loss; ELAP= exploratory laparotomy; HALS=hand assisted laparoscopic surgery; Hct=Hematocrit; VAS=visual analog scale.
| Patient # | Group | Age (years) | Disease | Surgery | 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 /Sent | 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 /IAO/ 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 | 300 | 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/ IAR/Cysto/Stents | Gyn Gen Surg | 22 | 128 | 100 | 3.9 | 3.53 | 4 |
| 11        | B     | 44          | Ovarian remnant/ endometriosis | Dx LSC/ELAP/IOA/IAR/R Ovarian remnant/Cysto/Stents | Gyn Gen Surg | 21 | 133 | 300 | 7.3 | 0.78 | 6 |
| 12        | B     | 43          | Rectal endometriosis | Dx LSC/ELAP/IAR/BSO/ Trachelectomy | Gen Surg | Gyn | 31 | 85 | 150 | 2.9 | 1.81 | 4 |
| 13        | B     | 36          | Ovarian remnant/ Multiple laparotomies | ELAP/IOA/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.
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 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.

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 (3.5 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 |
| 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                  | 26.9| 4.6  | 178     | 78  | 356 | 281     | 0.21*| 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, ELAP 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 | 34      | 0.64| 291 | 169    | 0.12| 5.5 | 2.9    | 0.1 | 2.5 | 1.4    | 0.64| 3.7 | 1.0    | 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 colpexies laparoscopically. HALS may allow the surgeon the opportunity to offer a minimally invasive alternative to the traditional abdominal sacral colpexy.

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. 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 concern-
ing. 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 pa-
tients 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 ab-
sorbable 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 an-
other potential means to consider in reducing hernia for-
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 stan-
dardization of the technique, HALS appears to be a prom-
ising modality in the world of benign gynecology.

References:
1. Munver R, Del Pizzo JJ, Sosa RE. The evolution and current
applications of hand-assist laparoscopy. Contemp Urol. 2003;12:
30–58.
2. Bemelman W, Witt LT, VVusch ORC, Gouma DJ. Hand-
assisted laparoscopic splenectomy. Surg Endosc. 1995;12:997–
998.
3. Meijer D, Bannenber JG, Jakimowicz JJ. Hand-assisted lapa-
roscopic surgery. Surg Endosc. 2000;12:891–895.
4. Romanelli JR, Kelly JJ, Litwin DE. Hand-assisted laparo-
scopic surgery in the United States: an overview. Sem Laparosc
Surg. 2001;8(3):96–103.
5. Spannuth WA, Rocconi RP, Huh WK, Straughn JM Jr., Barnes
MN 3rd. A comparison of hand-assist laparoscopy and conven-
tional laparotomy for the surgical evaluation of pelvic masses.
Gynecol Oncol. 2005;99:443–446.
6. Havrilesky LJ, Peterston BJ, Dryden DK, Soper JT, Clarke-
Pearson DL, Berchuck A. Predictors of clinical outcomes in the
laparoscopic management of adnexal masses. Obstet Gynecol.
2003;102:243.
7. Chi DS, Abu-Rustum NR, Sonada Y, et al. Laparoscopic and
hand-assisted laparoscopic splenectomy for recurrent and per-
sistent ovarian cancer. Gynecol Oncol. 2006;101:224–227.
8. Krivak TC, Elkas JC, Rose GS, et al. The utility of hand-assist
laparoscopy in ovarian cancer. Gynecol Oncol. 2005;96:72–76.
9. Schlaerth AC, Abu-Rustum NR. Role of minimally invasive
surgery in gynecologic cancers. Oncologist. 2006;11:895–901.
10. Pelosi MA, Pelose MA 3rd. Hand-assist laparoscopy for com-
p lex hysterectomy. J Am Assoc Gynecol Laparosc. 1999;6(2):183–
188.
11. Pelosi MA, Pelosi MA 3rd, Villalona E. Hand-assisted laparo-
scopic cholecystectomy at cesarean section. J Am Assoc Gynecol
Laparosc. 1999;6(4):491–495.