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Minimally Invasive Surgery in Gynecologic Oncology: A Review

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Abstract

Minimally invasive surgery has been utilized in the field of obstetrics and gynecology as far back as the 1940s when culdoscopy was first introduced as a visualization tool. Gynecologists then began to employ minimally invasive surgery for adhesiolysis and obtaining biopsies but then expanded its use to include procedures such as tubal sterilization L. E. Smale and M. L. Smale (1973), Thompson and Wheeless (1971), Peterson and Behrman (1971)). With advances in instrumentation, the first laparoscopic hysterectomy was successfully performed in 1989 by Reich et al. At the same time, minimally invasive surgery in gynecologic oncology was being developed alongside its benign counterpart. In the 1975s, Rosenoff reported using peritoneoscopy for pretreatment evaluation in ovarian cancer, and Spinelli reported on using laparoscopy for the staging of ovarian cancer. In 1993, Nichols used operative laparoscopy to perform pelvic lymphadenectomy in cervical cancer patients. The initial goals of minimally invasive surgery, not dissimilar to those of modern medicine, were to decrease the morbidity and mortality associated with surgery and therefore improve patient outcomes and patient satisfaction. This review will summarize the history and use of minimally invasive surgery in gynecologic oncology and also highlight new minimally invasive surgical approaches currently in development.

Keywords: Maternal; Pediatric; Health; Gestational; Vitamin D

Laparoscopy in Cervical Cancer

Radical Hysterectomy

Laparoscopic surgery has played a role in the treatment of cervical cancer since the late 1980s. Nichols reported on laparoscopic lymphadenectomy for cervical cancer in 1993, over 30 years ago. The laparoscopic radical hysterectomy with pelvic and para aortic lymph node dissection was then first reported by Nezhat a few years later. When compared to the traditional radical hysterectomy performed via laparotomy, the laparoscopic approach allows for less blood loss and a shorter hospital stay at the cost of slightly increased procedure times. A retrospective study from Memorial Sloan Kettering compared 195 laparotomy patients to 17 laparoscopy patients undergoing radical hysterectomy. In this study, there was no significant difference between mean pelvic lymph node count (30.7 versus 25.5), transfusion rate (21 versus 5.3%), or negative surgical margins (5.1 versus 0%). The mean operating room times (296 versus 371 minutes, $P < 0.01$), mean EBL (693 versus 391 mL, $P < 0.01$), and mean length of hospital stay (9.7 versus 4.5 days, $P < 0.01$) were significantly different with a lower EBL and shorter hospital stay in the laparoscopic group, but a longer mean operating time in the laparoscopic group. Another retrospective study, from MD Anderson, compared 54 laparotomy and 35 laparoscopic radical hysterectomies for cervical cancer. There was a significant difference in mean blood loss between the two groups (548 versus 319 mL), but no significant difference in transfusion rates (15 versus 11%). Again, the operative times were significantly longer in the laparoscopic group (344 versus 307 minutes), and the median length of stay was shorter in the laparoscopic group (5 versus 2 days, $P < 0.001$). The incidence of postoperative infectious morbidity including fever, wound cellulitis, urinary tract infection, pneumonia, intra-abdominal abscess, and necrotizing fasciitis was significantly greater in the patients undergoing laparotomy (53 versus 18% $P < 0.001$) [1].

All but one case had resumed menstruation, but there were no reported pregnancies. In 2010, Kim reported on 27 successful cases of laparoscopically assisted vaginal trachelectomy. Seventy-four percent of the tumors had a squamous histology while 22.2% were adenocarcinomas. All patients had negative resection margins, and the mean operating time was 290 min (range of 120-520). The mean estimated blood loss was 332 mL, and 6 patients (22%) did receive a transfusion. There were no intraoperative or postoperative complications and after a median follow-up time of the 31 months (range of 1-58), 1 patient had experienced a recurrence. Regular menstruation did resume in 24 patients; however, 8 patients reported decreased menstrual flow and 3 complained of new severe dysmenorrhea. Among the 6 patients attempting to conceive, 3 succeeded. Martin and Torrent reported on 9 cases, similar to the Kim study, where the vaginal cuff incision and cervical reconstruction were performed vaginally. Six patients had squamous cell carcinoma, and 3 had adenocarcinoma. Two were stage IA1 and 7 were IB1.The mean operative time was 270 minutes, and all patients had negative surgical margins. The mean hospital stay was 5.2 days and the mean time for restoration of normal urinary function was 2 weeks. After a mean follow up of 28 months (range 6-32), 4 patients had attempted pregnancy with 2 successes and one live full term birth. There was 1 recurrence of adenocarcinoma 14 months post trachelectomy that was treated with 3 cycles of cisplatin and paclitaxel and subsequent hysterectomy and radiation for eventual no evidence of disease status. When comparing these laparoscopic cases to trachelectomies performed via a vaginal approach, it appears that there is no difference in recurrence or pregnancy rates. From the previous data we can conclude that a laparoscopic approach to trachelectomies for cervical cancer is a feasible option [2].

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Laparoscopy in Endometrial Cancer

Hysterectomy and Staging

Historically, the surgical treatment of endometrial cancer has been performed via laparotomy. Laparoscopic technology has granted surgeons a method of treatment and staging in patients, who are likely to benefit the most given their tendency to have higher body mass indices and other associated comorbidities. The Gynecologic Oncology Group LAP2 Study randomized 2616 patients, in an approximately 2: 1 fashion, to a laparoscopic versus open approach for the treatment and staging of endometrial cancer. The primary endpoint of this study was to compare recurrence free survival rates with secondary endpoints being the comparison of perioperative complications, conversion rates, and length of hospital stay. Twenty-five percent of the laparoscopy group were converted to laparotomy. The most common reason for conversion was poor visualization, but age > 63, increasing BMI, and presence of metastatic disease all increased a patient's risk for conversion. The median operative time for the laparotomy group was 130 minutes versus 204 minutes for the laparoscopy arm ($P < 0.001$). The intraoperative complications (8 versus 10%), readmission rates (7 versus 6%), reoperation rates (2 versus 3%), and 30-day perioperative deaths (8 versus 10) were not significantly different between laparotomy and laparoscopy groups. Postoperative complications, including intestinal ileus, cardiac arrhythmia, antibiotic use, and hospital stay > 2 days were significantly less likely in the patients undergoing a laparoscopic approach, occurring in 21% of the laparotomy group and 14% of the laparoscopy group ($P < 0.001$). With regard to staging, 97% of the laparotomy group had documented para-aortic lymph nodes in the final specimen, which was significantly different from 94% of the laparoscopy group (P P = 0.002). After a median of 59.3 months of follow up for both groups, there were a total of 309 recurrences (210 laparoscopy, 99 laparotomy) and 350 deaths (229 laparoscopy, 121 laparotomy). The 3-year estimated cumulative incidence of recurrence for laparotomy patients was 10.24%, compared with 11.39% for laparoscopy patients, with a hazard ratio of 1.14 (CI-1.278-3.996). There was no difference in the estimated 5-year overall survival (89.9% in each group), postoperative adjuvant therapy, and site of recurrence. From this important study, we can conclude that a minimally invasive approach to the treatment of endometrial cancer is as good as an open approach with many benefits including fewer postoperative complications, a shorter hospital stay, and less blood loss. The Cochrane Collaboration published a review in 2012 that included 8 studies, of which at least 70% of patients had early stage endometrial cancer; the 2009 Walker study previously cited was included. When comparing laparoscopy to laparotomy, the review concluded that there were no differences in overall survival (HR 1.14, CI 0.62-2.10), recurrence free survival (HR 1.13, CI 0.90-1.42), or perioperative death (HR 0.76, CI 0.3-1.79) between the two groups. The estimated blood loss was lower in the laparoscopy group (mean difference of 106.82 mL, 95% CI: -141.59, -72.06), though the need for blood transfusion was not significantly different (95% CI: 0.21, 1.49). There was also no significant difference of bladder injury (RR = 0.49, 95% CI: 0.13, 1.86), bowel injury (RR = 1.49, 95% CI: 0.39, 5.72) or vascular injury (RR = 0.43, 95% CI: 0.08 to 2.32) between patients undergoing laparoscopy and laparotomy. The risk of severe postoperative complications was significantly lower with laparoscopy with a relative risk of 0.58 (95% CI: 0.37 to 0.91). Given the available data for the use of laparoscopy in endometrial cancer, laparoscopy seems to have significant perioperative and postoperative benefits in these patients without sacrificing the desired oncologic outcomes [3].

Laparoscopy in Ovarian Cancer

Laparoscopy has also been reported on for staging in early ovarian cancer. Chi reported a case-control study of 20 patients undergoing laparoscopy and 30 patients undergoing laparotomy. Baseline characteristics of age, BMI, primary disease site, histology, and tumor grade did not differ between the groups; however, 65% of the patients undergoing laparoscopy had a cancer diagnosis prior to surgery compared to only 23% of the laparotomy patients (P 0.003). There was no significant difference between laparoscopy and laparotomy in terms of the number of lymph nodes removed, the size of the omental specimen, the site of metastases, or complications. The mean operating times (321 versus 276 minutes, P 0.04), mean estimated blood loss (235 versus 367 mL, P P 0.003), and length of hospital stay were significantly different (3.1 versus 5.8 days, $P < 0.001$) favoring the laparoscopic group. Three postoperative complications (2 wound infections and 1 ileus) were reported, all of them in the laparotomy group. Park reported on a similar study that included 17 laparoscopic patients and 19 laparotomy patients. All patients in the laparoscopy group had previously undergone abdominal surgeries compared to 57.9% in the laparotomy group (P 0.013). There was no difference in the mean number of lymph nodes removed or time to adjuvant chemotherapy. The laparoscopy group differed significantly from the laparotomy group in regard to mean estimated blood loss (231 versus 505 mL, P P 0.001), mean number of days to the return of bowel movements (2 versus 3.8, $P < 0.001$), and mean postoperative stay (9.4 versus 14.1 days, P 0.002). There were 2 recurrences after a median follow up of 17 months in the laparoscopy group but there was no difference in disease-free or overall survival between the groups. Nezhat looked at 32 women with gross extra ovarian disease who all had their procedures started laparoscopically, but then, at surgeon discretion, they were placed in 1 of 3 groups: primary cytoreduction and interval debulking via laparoscopy (17 patients), primary cytoreduction and debulking via laparotomy (11 patients), or biopsies only (4 patients). The biopsy group included 2 primary gastrointestinal cancers, 1 benign struma ovari, and 1 primary peritoneal adenocarcinoma that declined debulking. All patients in the first group were stage IIIA or greater and 88.2% had optimal cytoreduction. The patients of the second group were stage IIIB or greater. Groups 1 and 2 did not differ with regard to mean operative time, intraoperative, or postoperative complications. There was a significant difference between Group 1 and Group 2 in regard to mean estimated blood loss (247 versus 609, P 0.008) and mean days of hospital stay (6.1 versus 8.2, P 0.03). The median time to recurrence for Group 1 was 31.7 months and 21.5 months for Group 2; however, this did not meet statistical significance (P P = 0.3). It appears that a laparoscopic approach is also feasible in the treatment of ovarian cancer, particularly in early stage disease, but more data is needed regarding long-term oncologic outcomes of these patients [4].

Robotics in Cervical Cancer

Radical Hysterectomy

Yet another minimally invasive approach that has gained popularity over the last several years is the use of robotic surgery in the treatment of gynecologic cancers. With the introduction of the robotic platform, there is now another modality by which to perform a radical hysterectomy. Lowe reported in 2009 on 42 patients who underwent a robotic-assisted radical hysterectomy. Stage of disease ranged from IA1 with lymphovascular space invasion to IB2. The median operative time was 215 minutes, median estimated blood loss was 50 cc, median lymph node count was 25, and the median hospital stay was 1 day. All patients

had negative parametrial and vaginal margins, but 12% had evidence of positive lymph nodes. There were 2 intraoperative complications (4.8%) that included 1 conversion to laparotomy to repair a cystotomy and 1 ureteral injury. Postoperatively, DVT occurred in 2.4% of the subjects, pyelonephritis in 2.4%, and infection in 4.8%. There were no readmissions or reoperations. Cantrell evaluated 63 robotic cases and compared outcomes to open radical hysterectomies and found some significant differences between the 2 groups perioperatively. When the robotic cases were compared to the laparotomy cases, there was a lower mean estimated blood loss (50 versus 400 mL, $P < 0.0001$), a higher median number of lymph nodes (29 versus 24, P 0.04), shortened operative time (213 versus 240 min, P 0.0015), and shorter hospital stay in the robotic population (1 versus 4 days, P $P < 0.0001$). After a median followup of 12.2 months in the robotic group and 28 months in the laparotomy group, there was no apparent difference in progression-free or overall survival. Geetha and Nair have reviewed 12 studies of robotic radical hysterectomies (including 327 patients) and 14 studies of open radical hysterectomies (1552 patients). In all studies, there was actually no statistical difference in the mean operative time. Concurrent with the above study by Cantrell et al., the mean blood loss was significantly lower in the robotic cases, the mean hospital stay was significantly lower in the robotic group, and the percentage of patients with infectious perioperative morbidity was significantly higher in the laparotomy group. With regard to oncologic outcomes, the mean nodal metastases, positive margins, and recurrence rates were not different between the groups. It appears that a robotic approach to radical hysterectomy for the treatment of cervical cancer is feasible and affords the same staging abilities as open surgery with less blood loss and a shorter hospital stay [5].

Radical Trachelectomy

Using robot assistance for a fertility-sparing surgery in early cervical cancer is reported in a number of case reports and case series. Persson recently published a retrospective cohort comparing 13 cases of robotic trachelectomy to 12 vaginal cases. The stage of disease was similar between the two groups with 4 women with stage IA1 cervical cancer in the vaginal group versus 4 in the robotic group, 2 in the vaginal group versus 5 in the robotic group with stage IA2, respectively, and 6 in the vaginal group versus 4 in the robotic group with stage IB1 cervical cancer, respectively. Two cases in the vaginal group and 1 in the robotic group were converted to radical hysterectomies due to close proximal margins or positive lymph nodes. The mean operative times for both groups were not significantly different (297 minutes in the robot group versus 254 minutes in the vaginal group; P 0.26). The robotic group did have significantly lower estimated blood loss (133 versus 289 mL; P 0.05) and shorter hospital stay (2.3 versus 3.6 days; P 0.02). There were no reported recurrences in either group. With regard to fertility, 5 women in the robotic group and 8 in the vaginal group actively attempted pregnancy postoperatively. Four women in the robotic group were successful, with 2 reported deliveries, and 7 women in the vaginal group were successful, with 10 births [6].

Exenteration

The morbidity of pelvic exenteration is reported to be as high as 50-60% with a 5-7% mortality rate. Robotic-assisted surgical techniques may help to decrease these associated morbidities. Although the approach is novel, there are a handful of case reports in the literature that confirm safety of the procedure and possible decrease in estimated blood loss and hospital stay for select patients [7].

Robotics in Endometrial Cancer

Given the high conversion rate in GOG LAP2, it seems prudent to search for a minimally invasive approach to endometrial cancer that can be utilized in older, obese patients. Robotics may solve some of the technical difficulties associated with laparoscopy including improved physician ergonomics. Lowe et al. reported on 405 patients from multiple medical centers who underwent robotic-assisted hysterectomy and staging for endometrial cancer. The mean operative time was 170.5 minutes, estimated blood loss was 87.5 mL, length of hospital stay was 1.8 days, and lymph node count was 15.5. The conversion rate to laparotomy was 6.7% with reasons such as grossly involved adnexa or nodal disease or uterine size greater than anticipated being cited as major reasons for conversion. Intraoperative complications were rare at 3.5% and postoperative complications occurred in 14.6% of patients, the majority of which were fever, urinary tract infection, DVT, and wound seroma. In 2012, Gaia et al. published a meta-analysis reviewing 589 robotic-assisted surgeries, 396 laparoscopic surgeries, and 606 open surgeries. When compared to laparoscopy, roboticassisted surgeries had a lower estimated blood loss (91.6 versus 182 mL, $P < 0.001$). Otherwise, there was no statistical difference in hospital length of stay (1.35 versus 1.9 days), number of aortic lymph nodes (10.3 versus 7.8), number of pelvic lymph nodes (18.5 compared with 17.8), operative times (219 versus 209 minutes), wound complications (2% versus 2.8%), rate of conversion to laparotomy (4.9% versus 9.9%), or "other" complications (stroke, ileus, lymphedema, nerve palsy, acute renal failure, lymphocyst, and urinary retention) (2 versus 3.8%, OR 0.54, CI 0.16-1.81, P 0.23). When compared to laparotomy, robotic-assisted surgeries had a longer mean operative time (207 versus 130 minutes, P $P < 0.005$), a lower mean estimated blood loss (101 versus 291 mL, $P < 0.005$), a shorter average hospital stay (1.2 versus 3.9 days, $P < 0.001$), a lower rate of wound complications (1.8 versus 13.7%, OR 0.13, CI 0.04-0.44. P 0.01), and a lower rate of "other" complications (3.8 versus 14.5%, OR 0.25, CI 0.10-0.60, P 0.01). There was no difference in the number of pelvic or aortic lymph nodes retrieved when Robotic-assisted surgeries were compared to laparotomy (18.0 versus 14.5 and 9.4 versus 5.7, resp.). Across all groups, there was no statistical difference in vascular, bowel, and bladder injuries, vaginal cuff dehiscence, thromboembolic events, or an unplanned return to the operating room for bleeding. Cancer patients specifically, there appears to be significant advantages. Subramaniam compared 73 obese women who underwent robotic surgery to 104 obese women who underwent laparotomy, though 8 patients in the robotic cohort underwent conversion to laparotomy (11%). The rates of lymphadenectomy between the two groups were similar (65.8% of the robotic group versus 56.7% of the laparotomy group, P P 0.227), as was the mean number of lymph nodes removed (8.01 versus 7.24, P 0.505). The mean operative time from skin opening to closure was significantly longer in the robotic group (246.2 versus 138.2 min, $P < 0.001$), as was the mean time in the operating room (303.2 versus 191.4 min, $P < 0.001$). The mean estimated blood loss (95.9 versus 408.9 cc, $P < 0.001$), percentage of patients receiving a blood transfusion (1.4% versus 13.5%, P 0.005), mean length of hospital stay (2.73 versus 5.07 days, P $P < 0.001$), wound complications (4.1% versus 20.2%, P 0.002), and non-wound complications (including cardiac, pulmonary, and gastrointestinal causes) (9.6% versus 29.8%, P 0.001) were significantly lower in the robotic group. Gehrig also specifically looked at higher BMI patients and compared 49 obese and morbidly obese women who underwent robotic surgery to 32 obese and morbidly obese women who underwent traditional laparoscopy. When compared to the laparoscopy group, the robotic group had a significantly lower mean

operative time (189 versus 215 minutes, *P* 0.0004), mean estimated blood loss (50 versus 150 mL, $P < 0.0001$), and mean hospital stay (1.02 versus 1.27 days, *P* 0.01). From this study we can counsel patients about the morbidity rates associated with robotic surgery for endometrial cancer and conclude that the overall intraoperative and postoperative complication rates following robotic surgery are low. Brudie reported on the recurrence-free survival and overall survival of 372 patients who underwent robotic surgery after a median followup of 31 months. Adjuvant therapies were not standardized but directed by physician preference. The risk of recurrence for all patients was 8.3%, with 4.6% of patients dying of their disease. The estimated 3-year recurrence-free survival for the entire group was 89.3% with an estimated 5-year overall survival of 89.1% and 92.5% and 93.4% for the endometrioid subset. These results appear very similar to those of the LAP2 study, reinforcing the idea of that disease outcomes are not altered when robotic assistance is used for endometrial cancer surgery. The use of robotics in the treatment of endometrial cancer seems promising with similar outcomes as laparoscopy and may bridge the gap between those patients who would otherwise not be treated with a minimally invasive approach due to either patient comorbidities or surgeon skill level [8].

Robotics in Ovarian Cancer

Debulking

Holloway describes the utility of robotic assistance in a patient with recurrent platinum-sensitive ovarian cancer who had a metastasis to her liver that was persistent after chemotherapy. They succeeded in a complete resection with negative margins in a total operating room time of 137 minutes and 100 mL estimated blood loss. Magrina compared 35 patients undergoing primary surgical treatment for ovarian cancer who underwent a robotic-assisted surgery to matched cohorts of patients who underwent laparoscopic and open procedures for the treatment of ovarian cancer. All groups were separated into 3 subgroups, depending on the extent of their surgery. Type I patients underwent a hysterectomy, an adnexectomy, an infracolic or infragastric omentectomy, a pelvic and aortic lymphadenectomy, an appendectomy, and the removal of metastatic peritoneal disease if it was present. Type II patients underwent a Type I debulking and 1 additional major procedure. Type III patients underwent a Type I debulking and 2 or more major procedures. Major procedures were described as any type of intestinal resection (modified posterior pelvic exenteration with low colorectal anastomosis, sigmoid resection with high anastomosis, transverse colon resection, ileocecal resection, and/or small bowel resection), full thickness diaphragm resection, resection of liver disease, and splenectomy. Of note, there were now laparoscopic Type III surgeries reported. Complete or incomplete debulking was based on whether there was visible residual tumor of any size at the conclusion of the case. Presence of FIGO stage III-IV disease was 60%, 75%, and 87% for robotics, laparoscopy, and laparotomy, respectively. The mean operating time was significantly longer in the robotic group when compared to the laparoscopic and laparotomy groups (315 versus 254 versus 261 minutes, $P\ P < 0.05$), except in the Type I surgeries (282 versus 249 versus 230 minutes, *P* 0.10). As expected from previous surgical reports, the mean estimated blood loss was significantly lower in the robotic and laparoscopic groups in comparison to the open group (164 versus 267 versus 1307 mL, $P < 0.05$). The overall mean hospital stay was much lower in the robotic and laparoscopic groups compared to laparotomy (4 versus 3 versus 9 days, $P < 0.05$). However, the length of stay for the Type III surgical patients did not differ between the robotic and open approaches (mean 11 versus 10 days). There was no statistically significant difference in intraoperative complications among the 3 groups in all 3 surgery types. Postoperative complications (within 42 days) were similar among all groups with a Type I surgery, lower for robotics and laparoscopy patients with a Type II surgery (25 versus 0 versus 54%, *P* 0.01), then similar between the robotic and laparotomy groups with a Type III surgery (100 versus 56%). The rate of complete debulking was greater in the robotic and laparoscopic arms than in the open arm (84 versus 93 versus 56%, $P\ P < 0.001$). However, this is likely attributable to surgeon surgical preference, choosing an open method for those with more disseminated disease. A valuable finding of this study is that it appears that disease state and complete debulking are more important in determining prognosis than the surgical approach. At our institution we are currently performing interval debulking surgeries with a robotic approach and have noted good outcomes with ability to remove all gross disease while decreasing blood loss and hospital stay associated with the procedure. It appears that patients with early stage ovarian cancer undergoing complete staging procedures and those undergoing neoadjuvant surgeries may benefit most from a robotic approach; however, the robotic approach may also be feasible for certain patients with stage III and greater disease undergoing a primary debulking procedure [9].

Adnexal Masses

Magrina has looked at 85 patients who underwent robotic-assisted surgery for adnexal surgery and compared them to 91 patients who underwent traditional laparoscopy. In the robotic group, the indication for surgery was an adnexal mass in 90% and prophylactic oophorectomy in 10% of patients. In the laparoscopy group, the indications were similar with 97% undergoing surgery for an adnexal mass and 3% undergoing prophylactic surgery. Demographically, the robotic group had a statistically higher number of obese patients (35 versus 18%, *P* 0.02), higher number of patients with an American Society of Anesthesiologists (ASA) physical status classification of 2 or 3 (45 versus 27%, *P* 0.04), and a higher number of patients who underwent a unilateral salpingo-oophorectomy (26 versus 3%, *P* 0.003). The mean operating time was significantly longer in the robotic group by 12 minutes (83 versus 71 minutes, *P* 0.01). This difference in operating times was not seen among obese patients (BMI of 30 or more) (80 versus 71 minutes, *P* 0.43). The mean estimated blood loss between the two groups was similar (41 versus 39 mL, $P\ P$ 0.65), except in the obese patients, where the blood loss was higher in the laparoscopy group (60 versus 39 mL, *P* 0.02). There was no significant difference in intraoperative or postoperative complications between the 2 groups, and no cases were converted to laparotomy. It appears from this study that obese patients may benefit the most from a robotic surgical approach to an adnexal mass, but there does not appear to be a significant difference in terms of complications and outcomes between a robotic and laparoscopic approach [10].

Laparoendoscopic Single Site Surgery (LESS)

Laparoendoscopic single-site surgery was first described back in 1973 by Wheeless and Thompson for their tubal sterilization technique. It was not until 1991 that Pelosi and Pelosi reported on its use to complete a total laparoscopic hysterectomy and bilateral salpingo-oophorectomy. Following these reports, the interest in such an approach waned, likely due to the difficulties of such procedures given the available technology at the time. Likely secondary to the advent of more sophisticated technologies, the LESS approach seems to have just recently gained momentum among gynecologic surgeons. These procedures are characterized by a single incision, very often through the umbilicus, through which either multiple ports are

placed or a single-port which can accommodate multiple ports and instruments. With its newly gained popularity, the descriptions for this surgical approach have varied from OPUS (One Port Umbilical Surgery) to SILS (Single-Incision Laparoscopic Surgery) to SPICES (Single-Port Incisionless Conventional Equipment Utilizing Surgery). In order to clarify surgeon communication and the research language, the Laparo Endoscopic Single-Site Surgery Consortium for Assessment and Research (LESSCAR) published a consensus statement in 2010 establishing the term laparo endoscopic single-site surgery (LESS) as the standard term to describe such surgery [11].

LESS in Gynecologic Oncology

Fader and Escobar first reported on the use of LESS in gynecologic oncology in 2009. This series included 13 patients, of whom 9 were performed on via LESS and 4 were with robotic-assisted LESS. One patient had staging for endometrial cancer, 1 had staging for granulosa cell ovarian cancer, 1 had a retroperitoneal pelvic lymph node dissection and peritoneal biopsies for a suspected right pelvic sidewall recurrence of papillary serous ovarian carcinoma, 2 had a risk reducing extra fascial hysterectomy and bilateral salpingooophorectomy, 5 had a risk-reducing BSO alone, 1 had an ovarian cystectomy for a mature cystic teratoma, and 2 had bilateral salpingo-oophorectomies for complex adnexal masses. There were no conversions to conventional multiport laparoscopy or open surgery, no postoperative complications, and no early port-site hernias noted. The median overall operating time was 65 min (range 35-178), but the median operating time for hysterectomy with or without a lymphadenectomy was significantly longer at 168 min (range 145-178 minutes). The mean hospital stay was 0.7 days. Eighty five percent of patients reported pain scores of 0-1 in the immediate postoperative period and at their follow-up visits, and 62% (including 2 of the 3 patients who underwent hysterectomies) reported not using narcotics at all as an outpatient. Surgeons attributed lack of instrument crowding in their cases to a laparoscope with a flexible tip and articulating instruments. Participating surgeons also determined that the surgical range of motion was increased in robotic cases when the Gelport was used as the access platform.

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None

Conflict of Interest

None

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