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Herniation formation in women undergoing robotically assisted laparoscopy or laparotomy for endometrial cancer

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Abstract

Objective—To compare the incidence of trocar site hernia in women who underwent robotically assisted laparoscopic surgery (RBT) for endometrial cancer staging with the incidence of ventral hernia formation in patients who underwent laparotomy (LAP) for the same indication. To analyze risk factors for hernia formation in women undergoing RBT for endometrial cancer.

Methods—We retrospectively identified all patients who underwent surgical staging for endometrial cancer via RBT or LAP from 2009–2012. Clinicopathologic data were analyzed. Appropriate statistical tests were used.

Results—738 patients were staged via RBT (n=567) or LAP (n=171). Overall median age was 61 years (RBT range, 33–90; LAP range, 28–86; p=0.4). Median BMI was 29.5 kg/m² (range, 17.9–66) and 30.3 kg/m² (range, 16.8–67.2), respectively (p= 1.0). Eleven (1.9%) of 567 patients in the RBT cohort developed a trocar site hernia compared with 11 (6.4%) of 171 LAP patients who developed a ventral hernia (p= 0.002). Median time to diagnosis was 18 months (range, 3–49) and 17 months (range, 7–30), respectively (p= 0.7). Of the 11 RBT patients who developed a trocar site hernia, 10 (91%) were midline defects and 1 (9%) was a lateral defect of a prior inferior epigastric port site. No hernias required emergent operative intervention. Four (0.7%) of 567 RBT patients compared with 2 (1.2%) of 171 LAP patients required surgical hernia repair (p=0.4).

Conclusions—Trocar site herniation after RBT staging for endometrial cancer is uncommon and less likely to occur than ventral hernia formation with LAP staging. Furthermore, surgical revision rates are low.

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Conflict of Interest Statement

The authors have no conflicts of interest to disclose.

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Keywords

robotic surgery; gynecologic surgery; laparotomy; trocar site herniation; ventral herniation; endometrial cancer

Introduction

Endometrial cancer is the most common gynecologic malignancy in the United States, with more than 52,000 new cases diagnosed in 2015 [1]. Surgical staging for endometrial carcinoma, including hysterectomy, bilateral salpingo-oophorectomy and lymphadenectomy, remains the standard of care for both treatment and prognosis [2]. Traditionally, surgical staging was performed via laparotomy. Results of the Gynecologic Oncology Group (GOG) LAP2 study, however, demonstrated the benefits of minimally invasive surgery for staging of endometrial cancer [3]. Specifically, a laparoscopic approach was associated with fewer postoperative complications and a shorter length of hospital stay. Since then, the use of laparoscopy has further increased, as gynecologic oncologists have incorporated the use of robotic surgical platforms to facilitate laparoscopy. In a 2015 survey of Society of Gynecologic Oncology (SGO) members, 97% of respondents reported using the robotic platform, and greater than 90% stated that robotic-assisted laparoscopic surgery was appropriate for use in the staging of endometrial cancer [4].

With the rapid growth of robotically assisted laparoscopic surgery over this past decade, there has been an increase in the literature focusing on operative outcomes and comparisons to traditional laparotomy [3, 5–12]. The incidence of trocar site hernias, although uncommon, has been shown to be a potential postoperative complication for patients who undergo robotic surgery [13, 14]. In sharp contrast, the reported incidence of ventral hernia formation in patients who underwent laparotomy for gynecologic malignancies ranges from 8.8% to 16.9% [15, 16].

Given the growing use of the robotic platform for surgical staging of endometrial cancer, our study sought to determine the incidence of trocar site hernias in this patient population. Our secondary objective was to evaluate all cases and identify potential prognostic factors for the development of trocar site hernias. Finally, we sought to compare the rate of hernia formation among patients who underwent robotically assisted laparoscopic surgery to the rate of ventral hernia formation among those who underwent laparotomy for endometrial cancer staging during the same time period.

Methods

After Institutional Review Board approval, we retrospectively identified all patients who underwent surgical staging for endometrial cancer at Memorial Sloan Kettering Cancer Center from January 2009 through December 2012, to allow for at least 2 full years of potential follow-up for capturing any cases of trocar site herniation that may have occurred during that time. Surgical staging included total hysterectomy, removal of adnexa, and lymph node evaluation via standard lymphadenectomy or sentinel lymph node mapping and biopsy. The surgical approach was categorized as laparotomy or robotically assisted

laparoscopic surgery depending on the type of surgical approach by which the case was completed. Data collection involved review of all operative notes, inpatient progress notes, and postoperative follow-up visits.

Demographic data collected for each patient included assessments of age, body mass index (BMI), and documented past medical history of hypertension, diabetes mellitus, and history of smoking within the 30 days prior to surgery. Confirmation of trocar site hernias within the robotic group was obtained through documentation of observed herniation on physical exam and/or radiographic evidence of bowel herniation on imaging with computed tomography scans or magnetic resonance imaging. Patients with noted trocar site hernias were evaluated for location and classified as either having midline or lateral defects. Notation of trocar type and performance of fascial closure was noted. Incidence of surgical repair post-diagnosis and indication as emergent or non-emergent was documented. For all laparotomy cases, confirmation of ventral herniation was established through documentation on physical exam, and instance of post-diagnostic operative repair was noted.

For all patients undergoing robotically assisted procedures, perioperative details, including time spent operating on the robotic console (between docking and undocking) and estimated blood loss (EBL), were noted. All attending physicians of record were fellowship-trained gynecologic oncologists. Routine setup for robotic surgery required the use of 5 ports: a 12-mm Hasson camera trocar placed either in the umbilical or supraumbilical region, two 8-mm robotic trocars in the bilateral lower quadrants, an 8-mm robotic trocar inferior to the right subcostal margin, and a 10/12-mm assistant trocar inferior to the left subcostal margin. General institutional practice includes primary fascial closure of all 12-mm midline camera ports.

Association statistical tests between the two groups and other demographic and clinical factors were performed through the Mann-Whitney U or Kruskal-Wallis test for continuous variables and the Chi Square or Fisher Exact test for categorical variables, as appropriate. All statistical analyses were performed on IBM SPSS Statistics ver. 22.0 (IBM SPSS Statistics for Windows 2013, Armonk, NY).

Results

Seven hundred thirty-eight patients with endometrial cancer who had undergone staging via a robotically assisted laparoscopic approach or via laparotomy were identified. This included 567 patients (77%) who underwent robotic surgery and 171 (23%) who underwent laparotomy. Demographic characteristics of each cohort are listed in Table 1. Median age in both cohorts was 61 (robotic range, 33–90; laparotomy range, 28–86; $p=0.4$). Median BMI was 29.5 kg/m² (range, 17.9–66 kg/m²) and 30.3 kg/m² (range, 16.8–67.2 kg/m²), respectively ($p=1.0$). No significant differences were noted in incidence of hypertension, diabetes mellitus, or smoking history between patient groups (Table 1).

With a median follow-up of 27 months (range, 0.3–77 months) for the entire cohort, trocar site hernias were noted in 11 robotic patients (1.9%) and ventral hernias were noted in 11

laparotomy patients (6.4%) ($p=0.002$; Table 2). The median time to diagnosis was 18 months (range, 3–49 months) and 17 months (range, 7–30 months), respectively ($p=0.7$).

Within the robotic cohort, the median age was 66 years (range, 58–80 years) in the patients who developed a hernia compared with 61 years (range, 33–90 years) in those who did not ($p=0.1$; Table 3). The median BMI was 38.8 kg/m^2 (range, $23.9\text{--}55.2 \text{ kg/m}^2$) for herniated cases and 29.5 kg/m^2 (range, $17.9\text{--}66 \text{ kg/m}^2$) for non-herniated cases ($p=0.05$). Again, no significant differences were noted in incidence of hypertension, diabetes mellitus, or smoking history between the hernia and non-hernia cohorts (Table 3). Panniculectomy was performed in 14 (8%) of 171 patients undergoing concurrent laparotomy; none of these cases were associated with subsequent formation of a ventral hernia. When investigating perioperative features between patients with and without herniation in the robotic cohort, median EBL was 100 mL (range, 50–250 mL) in the hernia cohort and 50 mL (range, 5–1200 mL) in the non-hernia cohort ($p=0.1$). Median time spent at the console was 105 minutes (range, 78–163) for the herniated cases and 134 minutes (range, 38–367 minutes) for the non-herniated cases ($p=0.2$).

Of the 11 robotic patients who developed a trocar site hernia, 10 (91%) were classified as midline defects and 1 (9%) as a lateral defect of a prior inferior epigastric port site (Figure 1). The 10 midline defects consisted of four umbilical camera port sites and six supraumbilical camera port sites. The median time to diagnosis was 18.5 months for the umbilical hernias, 7 months for the supraumbilical hernias, and 8 months for the lateral defect. There were no instances of trocar herniation requiring emergent intervention in any of the groups. All midline camera ports had primary fascial closure using a synthetic absorbable suture. The 8-mm lateral port site had not undergone fascial closure. Four (0.7%) of 567 patients from the robotic cohort ultimately underwent surgical repair of a trocar site hernia after diagnosis. In comparison, 2 (1.2%) of 171 patients in the laparotomy group required surgical repair for a ventral hernia ($p=0.4$). All cases of robotic trocar site hernia repair were of an elective nature and performed laparoscopically by a hernia specialist at our institution.

Discussion

In the current analysis, the incidence of trocar site hernia development following robotically assisted laparoscopy was significantly lower compared with the incidence of ventral hernia development following laparotomy (1.9% vs 6.4%, respectively) for the primary surgical management of endometrial cancer. Patients in the two groups demonstrated similar clinicodemographic characteristics and no differences in time to diagnosis or subsequent surgical intervention. Within the robotic cohort, no statistically significant differences were noted with respect to potential predictors of herniation, including age, presence of comorbidity, and perioperative detail. Of note, the only variable that bordered on statistical significance was that of BMI; patients who developed hernias compared with those who did not had a higher median BMI by approximately 10 kg/m^2 .

The use of robotically assisted laparoscopic surgery has grown exponentially within the past decade. Data regarding the safety and survival outcomes of patients undergoing robotic

surgery have increased accordingly. Multiple retrospective studies have demonstrated improvement in both EBL and length of hospital stay, as well as similar survival outcomes, among patients undergoing robotic compared with open surgery [6, 10–12]. A 2013 study from the University of North Carolina evaluating survival data from nearly 500 endometrial cancer patients who underwent staging with the robotic platform demonstrated a projected 5-year survival rate of 88.7% for all robotic patients included in the analysis [17]. Similarly, an analysis of 936 patients who underwent surgical staging for endometrial cancer through either a robotic approach or laparotomy between 2001 and 2013 demonstrated that operative type was not an independent prognostic factor for recurrence or overall survival on multivariate analysis [5].

However, with the increased use of robotic surgery has come the concern of new and unpredictable complications not seen with the traditional laparotomy approach. Fascial herniation, as typified by ventral hernia formation in patients who have undergone laparotomy for gynecologic cancers, has been infrequently described in the literature, but is associated with a notably high incidence when evaluated. In their 10-year experience with incisional hernias in 455 women who had undergone laparotomy for cervical or endometrial cancer through a vertical incision, Franchi et al demonstrated a 16.9% rate of subsequent hernia formation [15]. Data regarding ventral hernia formation in women who had undergone primary laparotomy for ovarian malignancies were notable for 1- and 2-year herniation rates of 8.8% and 23.4%, respectively [16]. Recent concern regarding the formation of trocar site hernias in patients undergoing laparoscopic surgery has led to the publication of a greater deal of literature on this topic, albeit of a retrospective nature and frequently with short or poorly defined follow-up [18–23]. In a 2011 meta-analysis among all surgical specialties of trocar site herniation in more than 30,000 adult patients undergoing laparoscopy, the overall incidence ranged from 0% to 5.2%, with 96% occurring at a trocar site of at least 10 mm and 82% localized to the umbilicus [19]. Notably, 57 (36%) of 160 trocar site hernias occurred between 30 days and 2 years after laparoscopic surgery. The topic of fascial closure for laparoscopic incisions has also remained controversial, with closure of larger port sites equally supported and refuted in the literature. In a study by Kadar and colleagues, incisional hernias were more commonly noted in patients with fascia left unsutured in 12-mm trocar sites, although this result was not statistically significant [21]. In a 2012 meta-analysis from the *British Journal of Surgery*, it was concluded that there is insufficient evidence for suturing the fascia of larger ports given multiple retrospective studies that demonstrated persistence of trocar site herniation despite fascial closure [24]. Larger randomized trials are also unlikely to yield further insight given the overall low prevalence of trocar site herniation.

Data regarding risk of trocar site hernia formation in patients undergoing robotic surgery is limited and frequently confined to case reports and small single-institution studies [25–29]. In the gynecologic literature, only two studies evaluating the incidence of trocar site herniation in women who have undergone robotic-assisted laparoscopic surgery included 500 or more patients [13, 14]. In a 2013 study by Clark et al, 3 cases of trocar site herniation were noted among 500 patients, with a median time to hernia formation of 21 days (range, 8–38 days), and an overall median follow-up of 13 months [14]. A similar analysis by

Boone and colleagues demonstrated no evidence of hernia formation in 842 study patients [13]. The follow-up time in that analysis was described as “for a maximum of 5 years,” with no specific median follow-up provided for the dataset. As previously described, the importance of follow-up in the diagnosis of fascial hernia formation cannot be underestimated, as reported in the case of Long et al, wherein the rate of ventral hernia formation in women with ovarian cancer more than doubled over the course of 1 year [16]. In comparison to the previously described studies, our study had a notably longer documented median follow-up time, which proved significant in identifying cases of trocar site herniation that occurred further out from time of initial surgery. Specifically, median time to trocar site herniation in our study was 18 months, emphasizing the benefit of this longer follow-up period for accurate diagnosis.

The strengths of this analysis can be found in the relatively large sample size, as well as the considerable median follow-up time of 27 months. Our addition of the rate of hernia formation for patients undergoing laparotomy for endometrial cancer during the same time period also provides a relevant data point. This is particularly important given the recent data from Chan et al that demonstrate a 62% rate of laparotomy for endometrial cancer staging in a nationwide query for the year 2010, despite the known benefits of minimally invasive surgery in this patient population [3, 30]. Limitations of our study are the same as those attributable to all retrospective analyses, including documentation error and bias in data record and review.

As the utility of the robotic platform for gynecologic conditions continues to grow, we will need to continue to monitor for efficacy and safety in patients undergoing robotically assisted laparoscopic surgery. As demonstrated in the literature, the robotic platform remains a viable tool to provide surgery through a minimally invasive approach for many women. Complications specific to the use of the robot are uncommon. In particular, the rate of trocar site hernia development following robotically assisted laparoscopy is significantly lower compared with the rate of ventral hernia development following laparotomy.

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Research Highlights

- Fascial herniation among women undergoing surgery for endometrial cancer is not uncommon
- Rates of fascial herniation are significantly less with robotic surgery compared with laparotomy
- Diagnosis of trocar site herniation can take many months to manifest, although overall rates of surgical revision are low

TTD= Time to diagnosis

Figure 1.
Summary of trocar site herniation and time to diagnosis
TTD=Time to diagnosis

Table 1

Patient Demographics

Patient Characteristic	RBT (n=567)	LAP (n=171)	p value
Age, years			0.412
Median	61	61	
Range	33–90	28–86	
BMI, kg/m²			0.981
Median	29.5	30	
Range	17.9–66	16.8–67.2	
Comorbidity			
Hypertension	252 (44%)	81 (47%)	0.501
Diabetes Mellitus	70 (12%)	20 (12%)	0.820
Smoker within 30 days	30 (5%)	11 (6%)	0.568

RBT= Robotically assisted laparoscopic surgery, LAP= Laparotomy, BMI = Body mass index

Table 2

Rates of hernia development among patients who underwent robotically assisted laparoscopic surgery and those who underwent laparotomy

	RBT (n=567)	LAP (n=171)	p value
Herniation	11 (1.9%)	11 (6.4%)	0.002
Time to diagnosis, months			0.748
Median	18	17	
Range	3–49	7–30	
Surgical repair	4 (0.7%)	2 (1.2%)	0.422

RBT= Robotically assisted laparoscopic surgery, LAP= Laparotomy

Table 3

Robotic clinicodemographics by hernia incidence

	RBT Hernia (n=11)	RBT No Hernia (n=556)	p value
Age, years			0.126
Median	66	61	
Range	58–80	33–90	
BMI, kg/m²			0.052
Median	38.8	29.5	
Range	23.9–55.2	17.9–66	
Comorbidity			
Hypertension	5 (45%)	247 (44%)	0.946
Diabetes Mellitus	1 (9%)	69 (12%)	0.597
Smoker within 30 days	0	30 (5%)	0.547
Console time, minutes			0.166
Median	105	134	
Range	78–163	38–367	
EBL, mL			0.115
Median	100	50	
Range	50–250	5–1200	

RBT= Robotically assisted laparoscopic surgery, BMI = Body mass index, EBL= Estimated blood loss