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Incidence of trocar site herniation following robotic gynecologic surgery

Leslie H. Clark, MD[a], **Pamela T. Soliman, MD**[b], **Diego Odetto, MD**[c], **Mark F. Munsell, MS**[d], **Kathleen M. Schmeler, MD**[b], **Nicole Fleming, MD**[b], **Shannon N. Westin, MD**[b], **Alpa M. Nick, MD**[b], and **Pedro T. Ramirez, MD**[b,*]

[a]Department of Obstetrics and Gynecology, University of North Carolina at Chapel Hill

[b]Department of Gynecologic Oncology & Reproductive Medicine, The University of Texas MD Anderson Cancer Center, Houston, Texas

[c]Department of Obstetrics & Gynecology, Hospital Italiano Garibaldi Rosario, Rosario, Argentina

[d]Department of Biostatistics, The University of Texas MD Anderson Cancer Center, Houston, Texas

Abstract

Objective—Trocar site herniation is a recognized complication of minimally invasive surgery, but published data on trocar site herniation after robotic surgery are scarce. We sought to determine the incidence of trocar site herniation in women undergoing robotic surgery for gynecologic disease.

Methods—A retrospective review of robotic surgeries performed from January 1, 2006, through December 31, 2012, was conducted. Postoperative trocar site herniations were identified, along with time to presentation, location of herniation, and management. Patients were excluded if surgery was converted to laparotomy or traditional laparoscopy. The Wilcoxon rank-sum test was used to compare patients with and without herniation with respect to continuous variables, and Fisher's exact test was used to compare these 2 groups with respect to categorical variables.

Results—The study included 500 patients, 3 of whom experienced herniation at a single trocar site. The patients with and without herniation did not differ with respect to age, body mass index, smoking status, medical comorbidities, operating time, or estimated blood loss. All 3 herniations occurred at 12-mm trocar sites. Two herniations occurred at assistant port sites, and 1 occurred at the umbilical camera port site. The median time to herniation was 21 days (range, 8-38 days). One patient required immediate surgical intervention; the other 2 patients had conservative management.

Conclusions—Trocar site herniation is a rare complication following robotic surgery. The most important risk factor for trocar site herniation appears to be larger trocar size, as all herniations occurred at 12-mm port sites.

Corresponding Author: Pedro T. Ramirez, The University of Texas MD Anderson Cancer Center, Department of Gynecologic Oncology& Reproductive Medicine, Unit 1362, Houston, TX 77030, peramire@mdanderson.org.

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Introduction

Laparoscopic surgery has significantly reduced the morbidity associated with the treatment of gynecologic cancer by decreasing blood loss, length of hospital stay, and time to patient recovery. Many gynecologic oncologists have adopted robotic surgery as a routine approach to treat gynecologic cancer, particularly endometrial cancer. Since the introduction of laparoscopic surgery, trocar port site herniation has become a well-recognized complication. Available estimates of the incidence of laparoscopic trocar site herniation across all surgical subspecialties, based on the largest available studies, range from 0.2% to 1.3%[1-5].

Three types of trocar site herniations have been described: (1) fascial and peritoneal separation (associated with early presentation), (2) fascial separation with intact peritoneum (associated with a later presentation), and (3) herniation of the entire abdominal wall (seen at the time of trocar removal or shortly after surgery) [3]. Early-onset hernias are the most commonly described and typically become apparent within 2 to 12 days after surgery. Patients with early-onset hernias most often present with small bowel obstruction, which can be a surgical emergency, often necessitating reoperation[3]. It has been reported that approximately 16% of trocar site herniations must be emergently repaired [1]. Late-onset hernias are also seen. Patients with late-onset hernias generally present with a bulge several months after surgery, ranging from 0.7-27 months [3]. The rate of reoperation in these patients is low, as late-onset hernias can often be managed conservatively.

The gynecologic literature includes 2 large retrospective studies[4,5] and several case reports/series on trocar site herniation following traditional laparoscopic surgery[6-9]. However, there are limited published data on trocar site herniation after robotic surgery, and most of these data come from case reports [10-12]. Given the routine use of robotic surgery in the treatment of gynecologic malignancies, we sought to determine the incidence of trocar site herniation after robotic gynecologic surgery.

Materials and Methods

A prospectively maintained robotic surgery database was queried to identify all robotic surgeries performed by the Department of Gynecologic Oncology and Reproductive Medicine at The University of Texas MD Anderson Cancer Center during the period from January 1, 2006, through December 31, 2012. Electronic medical records were queried for patient data, including patient age, weight, height, medical comorbidities, and tobacco use. Additionally, clinical data were collected, including data on type of operation performed, date of operation, estimated blood loss, operative complications, performance of fascial closure and fascial closure method, postoperative complications (including trocar site herniation, readmission, fever, wound complications, abscess formation, urinary tract infection, venous thromboembolism, and bowel and genitourinary complications), and length of postoperative follow-up. Follow-up was defined as the time from surgery to the last contact or clinic visit. By convention at MD Anderson, routine fascial closure is performed abdominally at the end of the procedure at all 12-mm port sites using a single stitch of 0-Vicryl, and no fascial closure is performed at 8-mm trocar sites. In our institution,

the only type of 12-mm trocar used is the Excel (Ethicon Endosurgery, Cincinnati, OH) bladeless trocar.

Trocar site herniation was defined as a documented palpable hernia on physical examination with radiologic confirmation of the herniation. In patients with herniation, information regarding necessary treatment, time to presentation of herniation, site of herniation, and hernia contents was obtained. Management of each herniation, including operative information, was also reviewed.

Patients were excluded from review if robotic surgery was converted to laparotomy or traditional laparoscopy. Statistical analysis was performed using SAS software, version 9.3, for Windows (SAS Institute Inc., Cary, NC). The Wilcoxon rank-sum test was used to compare median age, body mass index, operating room time, estimated blood loss, and follow-up time between patients with and without TSH. Fisher's exact test was used to compare these 2 groups of patients with respect to categorical variables (e.g., comorbidities, complications).

Results

A total of 545 planned robotic procedures were performed during the study period. Upon review of medical records, 45 procedures were excluded because the procedure was converted to laparotomy or records revealed that the procedure was actually performed with traditional laparoscopy. Among the remaining 500 procedures, 3 cases of trocar site herniation were identified in 3 patients (0.6% of patients; 95% CI, 0.13%-1.75%).

Patient demographics are summarized in Table 1. There was no difference between patients with and without trocar site herniation with regard to median age (44.5 years and 55.5 years, respectively, P=0.83), median body mass index (36.2 kg/m^2 and 30.5 kg/m^2, respectively, P=0.84), or proportion of patients who smoked (33.3% and 24.7%, respectively, P=0.58). There also was no difference between patients with and without trocar site herniation with regard to pre-existing medical comorbidities, including hypertension, diabetes, asthma, coronary artery disease, or chronic obstructive pulmonary disease (P=0.56). Of the 3 patients with trocar site herniation, 66.7% (2 patients) had undergone prior abdominal surgery, compared to 65.4% (325/497) of the patients without trocar site herniation (P=0.99). Pathologic evaluation of the surgical specimen revealed malignancy in 66.7% (2/3) of the patients with trocar site herniation and 74.6% (371/497) of those without it (P=0.99).

Surgical characteristics are summarized in Table 2. There was no difference between patients with and without trocar site herniation in median operating time (194 minutes and 207 minutes, respectively, P=0.92) or estimated blood loss (25 mL and 50 mL, respectively, P=0.06). Trocar site herniation was associated with type of procedure performed (P=0.01): no herniation occurred in procedures that included hysterectomy, whereas herniation occurred in 1 adnexal surgery and 2 staging procedures. Patients with and without trocar site herniation did not differ with regard to the rate of intraoperative complications(0% and 1.8%, respectively, P=0.99). Postoperative complications observed included urinary tract

infection, wound infection, vaginal cuff complications (hematoma, cellulitis, abscess), and herniations. Postoperative complications were significantly more common among patients with trocar site herniation, who by definition all had a postoperative complication (100% vs. 15.7%, *P*=0.004).

The details of the trocar site herniation cases are summarized in Table 3. The median time to herniation was 21 days (range, 8-38 days). The readmission rate for patients with trocar site herniation was 66.7% (2/3), compared to 5.2% (26/497) for patients without it (*P*=0.01). One patient with trocar site herniation did not require hospitalization because she was asymptomatic and computed tomography scan confirmed that the herniation contained only fatty tissue and not bowel.

All herniations occurred at 12-mm trocar sites. No hernias occurred at 8-mm robotic trocar sites. Standard practice for robotic surgery at our institution is to use two 12-mm ports (a midline camera port and a left-upper-quadrant assistant port) and three 8-mm robotic ports. Thus, the 500 patients in this study had one thousand 12-mm ports and fifteen hundred 8-mm ports, and the herniation rate was 0.3% for the 12-mm trocar ports and 0% for the 8-mm trocar ports.

Two hernias occurred at the assistant port, and in both cases multiple specimens were removed through the trocar site. One herniation occurred at the 12-mm umbilical camera port. Review of operative reports from the 3 patients with trocar site herniation showed that at all of the 12-mm port sites, including each of the port sites at which herniation occurred, fascial closure was performed using classic abdominal closure with a curved needle. The Carter-Thomason closure system and other available systems were not used in these 3 cases. The median follow-up time after surgery was 13.2 months (range, 0-69 months).

One of the 3 patients with trocar site herniations presented with acute onset of severe abdominal pain with nausea and vomiting 8 days following cold knife conization with pelvic lymph node dissection for an invasive poorly differentiated cervical adenocarcinoma. A computed tomography scan was performed, and results were consistent with a small bowel hernia at the left-upper-quadrant assistant port site. This patient required emergent reoperation with laparoscopic reduction of the hernia and hernia repair. The other 2 patients with trocar site herniations presented with asymptomatic abdominal bulges, and imaging confirmed herniation. Both hernias were managed conservatively. The first patient was seen and evaluated 9 months post-diagnosis of port site hernia and she was well and without complaints. The second patient was also well and without complaints 37 months after original diagnosis of port-site hernia.

Discussion

We found that the overall incidence of trocar site herniation following robotic surgery for gynecologic indications was low, at 0.6%. This incidence is similar to reported incidences of trocar site herniation following traditional laparoscopy despite the fact that robotic surgery requires slightly larger ports (8 mm vs. 5 mm). Two large retrospective studies on trocar site herniation risks in traditional laparoscopy for gynecologic indications showed an incidence

of hernias of 0.2%. The first study was a retrospective analysis by Kadar et al., published in 1993, of 3,560 patients who underwent traditional laparoscopy. These authors reported an overall incidence of trocar site herniation of 0.2% and rates of 0.23% (1/429) at 10-mm trocar sites and 3.1% (5/161) at 12-mm trocar sites (P=0.007). The authors found no cases of trocar site herniation at 5-mm trocar sites. Three of the 5 herniations occurred following attempted fascial repair at the close of the case. The authors also found that all cases of trocar site herniations occurred in extraumbilical port sites [4]. Mean follow-up time was not reported. In 1997, Nezhat et al. retrospectively reviewed 5,300 laparoscopic surgeries and found 111 trocar site hernias, for an incidence of 0.2%, including 5 herniations at 5-mm trocar sites and 6 cases that required reoperation [5]. Mean follow-up time in that study was 17.7 months.

Multiple risk factors for trocar site herniation have previously been identified. The most commonly cited risk factor is trocar size, with trocars larger than 12 mm being associated with significantly increased risk [2, 4]. Our study supports this risk factor in robotic surgery as all hernias occurred at 12-mm trocar sites and none occurred at 8-mm trocar sites. While trocar site herniations most commonly occurs at port sites larger than 10 mm in diameter, the gynecologic literature does include case reports of herniations at 5-mm trocar sites [5-9]. We found a single case report of herniation at an 8-mm trocar site following robotic surgery for gynecologic cancer. In this case, a 67-year-old woman presented with symptoms of small bowel obstruction on postoperative day 4 after an uncomplicated robotic hysterectomy with bilateral salpingo-oophorectomy and pelvic and para-aortic lymph node dissection. Herniation of small bowel through peritoneum and fascia at the left lateral 8-mm trocar site was noted. The trocar site was opened further to allow reduction of small bowel and fascial closure. No bowel resection or further exploration was deemed necessary[10]. We also found a single case report of herniation at an 8-mm trocar site following robotic prostate surgery[11]. The only previously published study on trocar site herniation after robotic surgery is a report in the urologic literature in which 2 herniations were seen at 10-mm and larger trocar sites and no herniations were seen at robotic trocar sites[12].

Other previously identified risk factors for trocar site herniation include pyramidal trocars, a long duration of surgery, manipulation of the trocar for specimen retrieval, closure of the fascia at the time of surgery, and umbilical location [2-4]. We observed no association of hernias with length of surgery (median, 207 minutes in patients without hernias vs. 194 minutes in those with hernias; P=0.92). We did see an association of hernias with type of procedure performed: no cases of trocar site herniation occurred in patients undergoing procedures that included hysterectomy, a fact that may reflect a protective effect of vaginal removal of specimens. Review of operative records revealed significant manipulation of trocars and specimen removal at the sites at which herniation occurred. Other previously reported important patient risk factors are older age and a higher body mass index [2]. Our study did not confirm these risk factors.

Even though the incidence of trocar site herniation in our series was low (0.6%), the potential need for reoperation and readmission makes trocar hernias an important consideration for surgeons performing robotic surgery. In our study, 1 of the 3 patients with trocar site herniation required emergent reoperation, which is consistent with rates seen in

patients with trocar site herniation after traditional laparoscopy. A large Danish review of more than 7,000 laparoscopic procedures showed that emergent reoperation was needed in 16% (15/95) of patients with trocar site herniation [13]. No patients in this large study or our study required bowel resection. The need for bowel resection due to incarcerated hernia has been reported [8,11]. In the 2 previously mentioned case reports of herniation at 8-mm robotic trocar sites, bowel resection was necessary in 1 case [10,11]. None of the available large reviews of trocar site herniation report the incidence of bowel resection following operation for trocar site herniation [1,2,4,5]. A review of 30 case reports of trocar site herniation reported a 17% (5/30) incidence of need for bowel resection when emergent reoperation was performed[3]. In our study, the readmission rate for patients with trocar site herniation was 66.7% (2/3), compared to 5.2% (26/497) for patients without it (P=0.01).

The strengths of our study include the large sample size and the median follow-up time of 13.2 months. Given that the majority of clinically significant hernias that necessitate reoperation become apparent in the first 30 days following surgery [1,3], our lengthy median follow-up time coupled with the fact that 90% of our patients had at least 30 days of follow-up makes us confident that we captured all clinically significant cases. Although this was a single-institution study, 8 robotic surgeons were included, allowing variations in surgeon closure techniques, which improve generalizability. Our study is limited by its retrospective nature and the biases inherent to retrospective studies. We also recognize that there might have been the possibility of under reporting the true hernia rate if considering patients who might have had an asymptomatic palpable hernia that was not documented by radiographic imaging. However, we feel confident that we have maximized our potential for capturing patients who suffered port site hernias based on prior studies that have shown that the median time to presentation in late-onset hernias was 5.5 months [3]. In addition, there was often limited documentation regarding the details of the fascial closure of the trocar sites—i.e., the type of instrument and the type of suture used.

In conclusion, our findings indicate that trocar site herniation is a rare complication following robotic surgery in gynecology. The incidence of this complication was 0.6% of all robotic procedures performed. We found no case of herniation at 8-mm trocar sites, which suggests that the overall risk of herniation at robotic trocar sites was zero in this study. In light of this information, routine closure of 8-mm trocar sites is likely to have low yield in preventing herniation. One might also consider that trocar site hernia rates may further be reduced by the use of the 8-mm camera port that is currently available for the robotic system.

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Research highlights

- The incidence of trocar site herniation in robotic gynecologic surgery was 0.6%.
- Age, body mass index, smoking status, and medical comorbidities were not risk factors.
- No herniations occurred at 8-mm robotic trocar sites in this series.

Table 1

Patient demographics

	TSH (n=3)	No TSH (n=497)	*P* value
Median age, years	44.5	55.5	0.83
Median body mass index, kg/m^2	36.2	30.5	0.84
Smoker, no. (%)	1 (33.3)	123 (24.7)	0.58
Medical comorbidities, no. (%)			0.56
Hypertension	1 (33.3)	208 (41.9)	0.99
Diabetes	0 (0)	90 (18.1)	0.99
Asthma	0 (0)	23 (4.6)	0.99
Coronary artery disease	0 (0)	11 (2.2)	0.99
Chronic obstructive pulmonary disease	0 (0)	8 (1.6)	0.99
Prior abdominal surgery, no. (%)	2 (66.7)	325 (65.4)	0.99
Malignancy, no. (%)	2 (66.7)	371 (74.6)	0.99

TSH, trocar site herniation.

Table 2

Surgical characteristics

	TSH (n=3)	No TSH (n=497)	*P* value
Median operating time, min	194	207	0.92
Median estimated blood loss, mL	25	50	0.06
Procedure, no. (%)			0.01
Hysterectomy ± BSO ± staging BSO/USO	0 (0)	343 (69.0)	
Staging	1 (33.3)	47 (9.5)	
Radical hysterectomy	2 (66.7)	23 (4.6)	
Radical trachelectomy	0 (0)	43 (8.7)	
Radical parametrectomy	0 (0)	16 (3.2)	
Other	0 (0)	10 (2.0)	
	0 (0)	15 (3.0)	
Intraoperative complications, no. (%)	0 (0)	9 (1.8)	0.99
Postoperative complications, no. (%)	3 (100)	78 (15.7)	0.004

BSO/USO, bilateral or unilateral salpingo-oophorectomy; TSH, trocar site herniation.

Table 3

Details of trocar site herniation cases

	Case 1	Case 2	Case 3
Procedure performed	Unilateral salpingo-oophorectomy	Pelvic LND for staging	Pelvic LND for staging
Location of hernia	Left upper quadrant, 10-mm port	Umbilical, 10-mm camera port	Left upper quadrant, 10-mm port
Days to presentation	38	21	8
Symptoms at presentation	Bulge on postoperative examination	Postoperative nausea	Acute pain, small bowel obstruction
Treatment of hernia	Conservative management	Conservative management	Laparoscopic reduction of small bowel obstruction and hernia repair

LND, lymphadenectomy.