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Brief Report

Vaginal Cuff Dehiscence after Robotic Hysterectomy in Endometrial Cancer vs. Non-Cancer Patients

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ABSTRACT

Introduction. Vaginal cuff dehiscence (CD) after hysterectomy is a rare but serious complication of robotic-assisted laparoscopic total hysterectomy (RLTH). The authors of this study aimed to compare the incidence and risk factors of CD following RLTH among patients with and without endometrial cancer.

Methods. This retrospective study included women aged 18 years or older who underwent RLTH by two surgeons at a single institution from 2013 to 2018. Patients with conversion to laparotomy, recent chemotherapy or radiation, or non-uterine malignancy were excluded. Data were abstracted from medical records.

Results. Of 950 patients meeting inclusion criteria, 50.7% had endometrial cancer. CD was reported in 2.5% of all patients. While adjusting for cancer status, age, sexual activity after surgery, distance from home to location of surgery, and time interval from surgery to loss to follow-up, obese patients were 25.1% less likely than non-obese patients to experience CD (62.5 vs. 37.5, p = 0.01). Surgeon A had a 2.8 times higher CD rate than surgeon B (70.8 vs. 29.2, p = 0.03). No other factors predicted CD.

Conclusions. Endometrial cancer patients were not at greater risk of experiencing CD compared to non-cancer patients. Surgeon differences and body mass index (BMI) were associated with CD risk, with normal BMI patients at higher risk. ***Kans J Med 2024;17:74-77***

INTRODUCTION

In gynecologic oncology, endometrial cancer is the most common indication for robotic-assisted laparoscopic total hysterectomy (RLTH).[1] Vaginal cuff complications following RLTH, including dehiscence, have been reported.[2,3] Vaginal cuff dehiscence (CD) is the separation of the anterior and posterior fibromuscular edges of the vaginal cuff, with or without bowel evisceration.[3] CD has an incidence of 0.4% to 4.1% following RLTH, a considerable increase compared to other methods of total hysterectomy.[2-7]

Variances in vaginal cuff closure, including suture technique, material, and approach, may alter the risk of CD following RLTH.[5,8-10] Risk of CD following RLTH also is associated with vaginal atrophy, tobacco use, obesity, and/or diabetes.[11] Post-operative trauma to the healing cuff, such as sexual activity, also is known to be a potential precipitating factor for CD.[10-12] Risk of CD following RLTH may also be associated with malignancy, specifically endometrial cancer.[13] This study sought to determine if there was a difference in the incidence and risk factors of CD following RLTH among patients with endometrial cancer compared to patients without endometrial cancer.

METHODS

Authors of this retrospective review utilized data abstracted from electronic medical records at a single institution. This study was approved by The University of Kansas Medical Center Institutional Review Board (IRB). Patients 18 years or older who had undergone RLTH (CPT codes: 58570, 58571, 58572, 58573) performed by two gynecologic oncology surgeons from 2013 through 2018 were included in this study. Patients were excluded if they had undergone chemotherapy and/or radiation within a year before or after the RLTH, had primary malignancies other than endometrial cancer, or had conversion to laparotomy during the RLTH.

Demographics, comorbidities, cancer status, cancer descriptors, RLTH surgical information, CD occurrence, precipitating events, dehiscence characteristics, and method of repair were abstracted and managed using REDCap® electronic data capture tools hosted at the University of Kansas Medical Center.[14,15]

Statistical Analysis. SAS version 9.4 (SAS Int. Inc., Cary, NC) was used for data analysis. CD incidence after RLTH among endometrial cancer patients was 1.3%[16] and among patients without endometrial cancer was 0.85%.[17] With these percentages, the power was calculated to be 0.859, indicating a required sample size of 1,000 patients. Two proportions using the Pearson's Chi-square approach were used, and normal approximation was assumed to approximate the sampling distribution of the difference in proportions between the two groups. This method assumed that the sampling distribution of the difference in proportions followed a normal distribution for the large sample size. The overall number of participants in the final analysis fell short of the intended sample size of 1,000 patients. Consequently, the power analysis was re-evaluated retrospectively using the sample size of 950, resulting in a power of 0.84, which met the statistical criteria for acceptability.

Frequencies, proportion, means, and standard deviations were calculated. Associations between nominal or categorical variables were tested using Pearson's Chi-square, likelihood ratio Chi-square, and Fisher's exact test. The Mann-Whitney U test assessed differences in dehiscence levels over the surgery to follow-up time interval. In cases of non-normal distribution, the rank transformation approach combined ranking and general linear modeling. Univariate and multiple logistic regression models employing Firth's bias-reduction penalized maximum likelihood estimation and explored the association between CD and explanatory variables. Fisher scoring, based on the expected information matrix, was used as an iterative algorithm. Statistical significance was set at $p < 0.05$ for all tests.

RESULTS

Out of 1,208 patients, 21.3% (n = 258) were excluded from the study. The remaining 950 patients were divided into two groups: those with endometrial cancer (50.7%, n = 482) and those without cancer (49.3%, n = 468).

The patients' ages ranged from 23 to 95 years, with an average age of 56 years (SD = 13.3; Table 1). Most patients were White or Caucasian (87.6%, n = 832), post-menopausal (65.4%, n = 600), and lived less than 50 miles from the surgery location (59.8%, n = 569). Among patients with endometrial cancer, the majority had Stage IA (80.1%, n = 386), Grade 1 disease (67.0%, n = 323), had an endometrioid histologic type (90.9%, n = 438), and received pelvic lymph node dissection at the time of surgery (75.1%, n = 362).

Table 1. Patient demographics and clinical characteristics.

Characteristics	Endometrial Cancer Patients n = 482	Non-Cancer Patients n = 468	Chi-Square (df)	P-Value
Age			230.5 (1)	<0.001
18 to 49 Years	48 (10)	263 (56.2)		
50 Years or Older	434 (90)	205 (43.8)		
Race			10 (3)	0.020
White or Caucasian	437 (90.6)	395 (84.4)		
Black or African American	13 (2.7)	22 (4.7)		
Asian American	4 (0.8)	12 (2.6)		
Other	28 (5.8)	39 (8.3)		
Ethnicity			3.8 (2)	0.150
Hispanic or Latino	24 (5)	30 (6.5)		
Not Hispanic or Latino	457 (95)	433 (93.5)		
Body Mass Index (BMI)			75.8 (4)	<0.001
Less than or equal to 18.5	1 (0.2)	13 (2.8)		
18.6 to 24.9	46 (9.5)	107 (22.9)		
25 to 29.9	77 (16)	116 (24.8)		
30 to 39.9	194 (40.3)	151 (32.3)		
Greater Than or Equal to 40	164 (34)	81 (17.3)		
Menopause Status (n = 917)			193.5 (1)	<0.001
Postmenopausal	407 (86.8)	193 (43.1)		
Premenopausal	62 (13.2)	255 (56.9)		
Parity (n = 948)			7.8 (4)	0.100
0	113 (23.4)	95 (20.4)		
1	53 (11)	70 (15)		
2	136 (28.2)	151 (32.4)		
3	110 (22.8)	98 (21)		
4 or more	70 (14.5)	52 (11.2)		
Hypertension Status			55.5 (1)	<0.001
No	214 (44.4)	320 (68.4)		
Yes	268 (55.6)	148 (31.6)		
Diabetes			37.2 (3)	<0.001
Not Diabetic	361 (74.9)	418 (89.3)		
Diabetes Type 1	2 (0.4)	4 (0.9)		
Diabetes Type 2	116 (24.1)	44 (9.4)		
Diabetes Type Unknown	3 (0.6)	2 (0.4)		
Smoking Status			18.3 (3)	<0.001
Never Smoker	362 (75.9)	306 (66.8)		
Current Smoker (at time of surgery)	31 (6.5)	65 (14.2)		
Former Smoker	84 (17.6)	87 (19)		
Distance from Home to Surgical Center (n = 946)			7.8 (3)	0.049
Less Than 50 Miles	274 (57)	295 (63.4)		
50 to 99 Miles	77 (16)	80 (17.2)		
100 to 199 Miles	97 (20.2)	67 (14.4)		
200 miles or more	33 (6.9)	23 (5)		
Surgeon			0.7 (1)	0.400
Surgeon A	245 (50.8)	225 (48.1%)		
Surgeon B	237 (49.2)	243 (51.9%)		
Endometrial Cancer Stage				
Stage IA	386 (80.1)			
Stage IB	75 (15.6)			
Stage II	3 (0.6)			
Stage III	15 (3.1)			
Stage IV	2 (0.4)			
Unknown/Not Recorded	1 (0.2)			
Endometrial Cancer Grade				
Grade 1	323 (67)			
Grade 2	114 (23.7)			
Grade 3	43 (8.9)			
Unknown/Not Recorded	2 (0.4)			
Endometrial Histologic Type				
Carcinosarcoma	2 (0.4)			
Endometrioid	438 (90.9)			
Serous	24 (5)			
More Than One	12 (2.5)			
Other	5 (1)			
Unknown/Not Recorded	1 (0.2)			
Pelvic Lymph Node Dissection Performed at Surgery				
No	120 (24.9)			
Yes	362 (75.1)			

Data are presented as n (%), unless otherwise indicated. Some totals may not add up to 100% due to missing values.

The suture type most frequently used for vaginal cuff closure by both surgeons was Polyglactin 9/10 (92.0%, n = 874). The most common suture technique for vaginal cuff closure (95.9%, n = 911) involved two sutures running from lateral to midline.

More non-cancer patients (57.1%) reported being sexually active after surgery than cancer patients (32.5%; χ^2 [2, N = 947] = 51.5, p < 0.001). A greater proportion of non-cancer patients (63.4%) lived

less than 50 miles from the surgery location compared to endometrial cancer patients (57.0%; χ^2 [3, N = 946] = 7.8, p = 0.049). There was no significant difference in the number of endometrial cancer patients treated by surgeon A compared to surgeon B.

CD occurred in 2.53% (n = 24) of all patients. The incidence of CD among endometrial cancer patients was 1.9% (n = 9) and 3.2% (n = 15) among non-cancer patients (χ^2 [1, N = 768] = 2.2, p = 0.139). Among patients diagnosed with CD, 29.2% (n = 7) reported a precipitating event, with intercourse being the most reported trigger (85.7%, n = 6). Of all CD occurrences, 16.7% (n = 4) involved overt evisceration of intra-abdominal contents, while 83.3% (n = 20) were classified as occult separation of the vaginal cuff, defined as a visibly or palpably thin membrane with peritoneal fluid or abdominal contents pushing against it, with or without a surrounding ring of scar tissue.

On average, patients were lost to follow-up 284 days after surgery. Patients living closer to the surgery location were lost to follow-up after a longer period (F[3, 942] = 3.5, p = 0.015) than those living further away. Patients living 50 miles or less were lost to follow-up 320 days after surgery, compared to 181 days for patients living 200 or more miles away. Endometrial cancer patients were lost to follow-up an average of 422 days post-surgery, compared to 140 days for non-cancer patients.

Among patients with CD, the condition was reported an average of 138 days post-surgery, with a median of 58 days post-surgery. Lastly, patients with CD were lost to follow-up 532 days post-surgery on average.

As shown in Table 2, CD was more common among patients with a normal BMI (41.7%) compared to overweight (25.0%) and obese patients (29.2%; χ^2 [2, N = 768] = 13.2, p = 0.001). Of the 24 cases of CD, 70.8% (n = 17) were patients of surgeon A (χ^2 [1, N = 768] = 6.7, p = 0.010).

Table 2. Testing association between CD and patient factors.

Patient Factors	Cuff Dehiscence			
	No	Yes	Chi-Square (df)	P-value
Age			0.7 (1)	0.390
18 to 49 years	247 (33.2)	10 (41.7)		
50 years or older	497 (66.8)	14 (58.3)		
BMI			13.2 (3)	0.001
Less than or equal to 18.5	11 (1.5)	1 (4.2)		
18.5 to 24.9	114 (15.3)	10 (41.7)		
25 to 29.9	154 (20.7)	6 (25)		
Greater than or equal to 30	465 (62.5)	7 (29.2)		
Diabetes			3.1 (1)	0.080
Patients with diabetes	134 (18)	1 (4.2)		
Patients without diabetes	610 (82)	23 (95.8)		
Sexually active after surgery				0.100
No	357 (54.7)	9 (37.5)		
Yes	296 (45.3)	15 (62.5)		
Surgeon			6.7 (1)	0.010
A	329 (44.2)	17 (70.8)		
B	415 (55.8)	7 (29.2)		
Distance from home to surgery location			1.7 (1)	0.190
Less than 50 miles	459 (61.7)	18 (75)		
Greater than or equal to 50 miles	285 (38.3)	6 (25)		

Table 2. Testing association between CD and patient factors. *cont.*

Patient Factors	Cuff Dehiscence			
	No	Yes	Chi-Square (df)	P-value
Patient type			2.2 (1)	0.140
Endometrial cancer patient	393 (52.8)	9 (37.5)		
Non-cancer patient	351 (47.2)	15 (62.5)		

Data are presented as n (%).

While controlling for other predictor variables, Table 3 illustrates that obese patients were 25.1% less likely than patients with a normal BMI to experience CD (p = 0.011). Additionally, CD was 2.8 times more likely to be reported when surgery was performed by surgeon A compared to surgeon B (p = 0.027). The remaining predictors in the model (cancer status, age, sexual activity after surgery, distance from home to the surgery location, and time interval from surgery to loss to follow-up) were not associated with CD.

Table 3. Logistic regression model of patient characteristic predictors of CD.

Predictors	Wald χ2	P-value	Odds Ratio	95% Confidence Interval
Cancer status				
Endometrial cancer patient	0.80	0.37	0.6	(0.20, 1.83)
Non-cancer patient	(Ref)	(Ref)	(Ref)	(Ref)
Age				
50 years or older	0.18	0.67	1.25	(0.44, 3.57)
Younger than 50 years	(Ref)	(Ref)	(Ref)	(Ref)
BMI				
Obese (greater than 30)	6.49	0.01	0.25	(0.09, 0.73)
Overweight (25 to 29.9)	1.62	0.20	0.50	(0.17, 1.46)
Underweight (less than 18.5)	0.10	0.76	1.43	(0.15, 13.20)
Normal weight (18.5 to 24.9)	(Ref)	(Ref)	(Ref)	(Ref)
Surgeon				
Surgeon A	4.87	0.03	2.80	(1.12, 7.00)
Surgeon B	(Ref)	(Ref)	(Ref)	(Ref)
Sexually active after surgery				
No	0.93	0.33	0.64	(0.25, 1.59)
Yes	(Ref)	(Ref)	(Ref)	(Ref)
Distance				
Less than 50 miles	0.67	0.41	1.50	(0.57, 3.98)
50 miles or more	(Ref)	(Ref)	(Ref)	(Ref)
Time interval from surgery to loss to follow-up	3.43	0.06	1.00	(0.99, 1.01)

DISCUSSION

Our study reports a 2.5% incidence of CD after RLTH, with incidences of 1.9% in endometrial cancer patients, and 3.2% in non-cancer patients. We found no increased risk of CD among endometrial cancer patients compared to non-cancer patients. Additionally, the current

study suggests that BMI and surgeon are the only variables associated with incidence of CD.

BMI was significantly associated with CD occurrence. Our study suggests obese patients were less likely to experience CD. These findings are supported by a prior study suggesting obesity to be a protective factor against CD after total laparoscopic hysterectomy or RLTH.[18] Intercourse was the inciting event in six of the seven cases with identifiable precipitating events. Donnellan et al.[18] hypothesized differences in positioning during intercourse may confer decreased force to the vaginal cuff among obese women compared to underweight or normal weight women. Therefore, women with a greater BMI may be at less of a risk for CD when resuming sexual activity after RLTH compared to women with a lesser BMI.

Both surgeons used the same suture material and nearly always used the same closure technique, suggesting there may have been a confounding factor. Some possible factors include patient demographics and sexual activity. Both surgeons used the same method of colpotomy for every surgery, so we were unable to determine if there was an association between CD and colpotomy technique.

Limitations. We excluded patients undergoing chemotherapy and/or radiation within a year before or after RLTH to avoid the confounding negative effects that these treatments could potentially have on wound healing and tissue integrity.[13] However, by excluding these patients, we consequently excluded those with high stage/grade endometrial cancer, which may be a limitation of this study. Additionally, our sample size did not meet the original power calculation requirements. Retrospectively, however, our power was still statistically acceptable.

Because many patients in this study reside outside a 50-mile radius of the surgery center, we anticipated a risk of potentially missed CD diagnoses due to follow-up examinations at outside facilities. We attempted to account for this by considering this variable in our data analyses. Despite this, CD may be underreported in the group living further from the surgery center.

The timing and frequency of resumed post-operative intercourse could not be determined or controlled for, making it difficult to analyze how intercourse affected cuff healing in this study. This limitation could also explain the difference in CD rates between surgeons A and B.

Finally, endometrial cancer patients had a longer follow-up period than non-cancer patients, likely due to the necessity of surveillance for relapse or spread of disease, which would be unnecessary in patients with benign indications for RLTH. This could affect the reported incidence of CD in non-cancer patients, as CD is less likely to be seen and diagnosed in patients with limited follow-up. Similarly, we anticipate that there are patients who have undetected CD or may eventually experience symptoms of CD in the future.

CONCLUSIONS

Our findings suggest that the identifiable incidence of CD after RLTH is 2.5%. Endometrial cancer patients were not at greater risk of experiencing CD compared to non-cancer patients. Surgeon differences and BMI were the only variables associated with the incidence of CD, with patients having a normal BMI being most likely to report experiencing this complication. Nearly one-third of patients with CD reported a precipitating event, with sexual intercourse being the most reported.

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REFERENCES

1 Bouquet de Joliniere J, Librino A, Dubuisson JB, et al. Robotic surgery in gynecology. Front Surg 2016; 3:26. PMID: 27200358.
2 Uccella S, Ghezzi F, Mariani A, et al. Vaginal cuff closure after minimally invasive hysterectomy: Our experience and systematic review of the literature. Am J Obstet Gynecol 2011; 205(2):119 e111-112. PMID: 21620360.
3 Kho RM, Akl MN, Cornella JL, Magtibay PM, Wechter ME, Magrina JF. Incidence and characteristics of patients with vaginal cuff dehiscence after robotic procedures. Obstet Gynecol 2009; 114(2 Pt 1):231-235. PMID: 19622982.
4 Nick AM, Lange J, Frumovitz M, et al. Rate of vaginal cuff separation following laparoscopic or robotic hysterectomy. Gynecol Oncol 2011; 120(1):47-51. PMID: 20869763.
5 Uccella S, Ceccaroni M, Cromi A, et al. Vaginal cuff dehiscence in a series of 12,398 hysterectomies: Effect of different types of colpotomy and vaginal closure. Obstet Gynecol 2012; 120(3):516-523. PMID: 22914459.
6 Fuchs Weizman N, Einarsson JI, Wang KC, Vitonis AF, Cohen SL. Vaginal cuff dehiscence: Risk factors and associated morbidities. JSLS 2015; 19(2). PMID: 25901104.
7 Kashani S, Gallo T, Sargent A, Elsahwi K, Silasi DA, Azodi M. Vaginal cuff dehiscence in robotic-assisted total hysterectomy. JSLS 2012; 16(4):530-536. PMID: 23484559.
8 Cronin B, Sung VW, Matteson KA. Vaginal cuff dehiscence: Risk factors and management. Am J Obstet Gynecol 2012; 206(4):284-288. PMID: 21974989.
9 Hur HC, Guido RS, Mansuria SM, Hacker MR, Sanfilippo JS, Lee TT. Incidence and patient characteristics of vaginal cuff dehiscence after different modes of hysterectomies. J Minim Invasive Gynecol 2007; 14(3):311-317. PMID: 17478361.
10 Iaco PD, Ceccaroni M, Alboni C, et al. Transvaginal evisceration after hysterectomy: Is vaginal cuff closure associated with a reduced risk? Eur J Obstet Gynecol Reprod Biol 2006; 125(1):134-138. PMID: 16154253.
11 Nezhat C, Kennedy Burns M, Wood M, Nezhat C, Nezhat A, Nezhat F. Vaginal cuff dehiscence and evisceration: A review. Obstet Gynecol 2018; 132(4):972-985. PMID: 30204700.
12 Ceccaroni M, Berretta R, Malzoni M, et al. Vaginal cuff dehiscence after hysterectomy: A multicenter retrospective study. Eur J Obstet Gynecol Reprod Biol 2011; 158(2):308-313. PMID: 21723030.
13 Payne WG, Naidu DK, Wheeler CK, et al. Wound healing in patients with cancer. Eplasty 2008; 8:e9. PMID: 18264518.
14 Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)--a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform 2009; 42(2):377-381. PMID: 18929686.
15 Harris PA, Taylor R, Minor BL, et al. The REDCap consortium: Building an international community of software partners. J Biomed Inform 2019; 95:103208. PMID: 31078660.
16 Park DA, Lee DH, Kim SW, Lee SH. Comparative safety and effectiveness of robot-assisted laparoscopic hysterectomy versus conventional laparoscopy and laparotomy for endometrial cancer: A systematic review and meta-analysis. Eur J Surg Oncol 2016; 42(9):1303-1314. PMID: 27439723.
17 Dauterive E, Morris GT. Incidence and characteristics of vaginal cuff dehiscence in robotic-assisted and traditional total laparoscopic hysterectomy. J Robot Surg 2012; 6(2):149-154. PMID: 27628278.
18 Donnellan NM, Mansuria S, Aguwa N, Lum D, Meyn L, Lee T. Obesity and older age as protective factors for vaginal cuff dehiscence following total hysterectomy. Gynecol Surg 2015; 12(2):89-93. PMID: 25960707.

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