Original article

Minimally invasive surgery for gynecological cancers: Experience of one institution

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ABSTRACT

Objective: Minimally invasive techniques are increasingly used in gynecological cancer surgery. Although many studies worldwide have looked at the safety and outcomes of the laparoscopic approach to gynecological cancers, there is a lack of data on this subject in our local setting. We therefore reviewed the safety and morbidity of laparoscopic techniques for gynecological cancers in Singapore's largest gynecological cancer center.
Methods: We carried out a retrospective review of a prospectively maintained database of all patients from Kerdang Kerbau Women's and Children's Hospital who underwent laparoscopic staging surgery for gynecological cancers over a 5-year period from January 2008 to December 2012. We obtained information on patient demographics, the clinical–pathological features, and perioperative and follow-up details, including intraoperative and postoperative complication rates, from clinical notes and electronic records.
Results: In total, 142 patients were included in the study. Ninety-eight patients underwent full staging surgery for endometrial cancer and 44 patients underwent full staging surgery for cervical cancer. One hundred and twenty-one operations were laparoscopic hysterectomies and 21 were laparoscopic radical hysterectomies. The overall conversion rate was 0.7%. The median length of the operation, the length of stay in hospital, the intraoperative complications, the lymph node yield, and the postoperative complication rates were comparable with previously published data from other institutions. At a median follow-up time of 29 months, the recurrence rates were 4.1% and 14.2% for laparoscopic hysterectomy and laparoscopic radical hysterectomy, respectively.
Conclusion: Laparoscopic surgery for gynecological cancers at our institution is safe, with morbidity statistics comparable with those of other centers.

Introduction

The advent of minimally invasive techniques has revolutionized the approach to surgery for gynecological cancers. The use of laparoscopy in endometrial and cervical cancer was first proposed by Childers et al[1] and Nezhat et al[2] in the 1990s and since then several randomized trials and meta-analyses have provided evidence that supports the use of laparoscopic-assisted surgery over traditional open surgery for early stage cancers. The reported advantages of a laparoscopic approach in gynecological cancer surgery include lower blood loss and transfusion rates, less pain and requirement for analgesia, faster postoperative recovery times, and earlier commencement of adjuvant radiotherapy or chemotherapy with no significant compromise in morbidity or risk of recurrence.[3–7]

Endometrial cancer surgery has historically been performed via a laparotomy approach. This includes careful survey of the abdomen and pelvis, peritoneal washing, total abdominal hysterectomy with bilateral salpingo-oophrectomy, and pelvic lymphadenectomy. This holds true for surgeries dealing with cervical cancer, with the main difference being that a radical hysterectomy is performed for the treatment of certain stages of cervical cancer.

Although much work has been carried out worldwide to look at the outcomes and complications of minimally invasive techniques in the management of gynecological cancers, there is a lack of local

data for Singapore. We therefore reviewed the safety and morbidity of minimally invasive techniques in gynecological cancer surgery in Singapore's largest gynecological cancer center.

Materials and methods

A retrospective review was carried out of all patients from the Kerdang Kerbau Women's and Children's Hospital who underwent laparoscopic staging surgery for gynecological cancer over a 5-year period from January 2008 to December 2012.

Patients with preinvasive cancers and patients who did not undergo full surgical staging in the initial procedure were excluded. This included patients who were incidentally diagnosed with cancer postoperatively via histology and those who were thought to be unfit for surgery or who did not undergo full staging procedures for other reasons.

Full surgical staging for endometrial cancer consists of total hysterectomy, bilateral salpingo-oophorectomy, pelvic lymph node dissection, and peritoneal washings for cytology. Para-aortic lymph node dissection and omentectomy may also be performed for high-grade tumors and serous or clear cell histological subtypes. For cervical cancer, FIGO clinical early stage 1A1 disease is usually treated by laparoscopic hysterectomy and bilateral salpingo-oophorectomy. For FIGO clinical stage 1A2 to 1B1 disease, modified radical or radical hysterectomy, bilateral salpingo-oophorectomy, and pelvic lymph node dissection are performed. More advanced or metastatic cervical cancers are usually treated with chemo—radiation therapy or palliative care depending on the stage.

As a standard protocol in our institution, all patients receive perioperative and postoperative antibiotic prophylaxis as well as postoperative graduated compression stockings and treatment with subcutaneous low molecular weight heparin unless contraindicated.

Patients were identified from our institution's prospectively maintained cancer database. Data were obtained through a review of the patients' medical records and the electronic records where applicable. The data collated included patient demographics, the pathology of the disease, the length of follow up, and also operative information, including operating room time, estimated blood loss, requirement for transfusion, lymph node count, the need for conversion to laparotomy and indications for doing so, length of hospital stay, pain score based on the Wong—Baker facial pain scale, and timing to first diet of choice. All operative and postoperative complications related to the operation were recorded. Any unexpected or unplanned event requiring intraoperative or postoperative intervention was defined as a complication. Postoperative complications were broadly classified into two categories of early and late complications. A duration of 1 month was used to discriminate between the two categories. Where applicable, all complications were graded according to the Clavien classification.[8] Complications of grade 2 and above were considered during the analysis of postoperative complications to facilitate comparison with other studies that defined postoperative complications in a similar manner.

Results

A total of 142 patients were identified for inclusion in the study. Of these, 98 patients underwent full staging surgery for endometrial cancer and 44 for cervical cancer. One hundred and twenty-one patients had a laparoscopic hysterectomy and 21 had a laparoscopic radical hysterectomy. All operations were performed by a consultant gyne-oncologist in our center. Tables 1 and 2 show the

Table 1
Baseline characteristics, disease pathology, and duration of follow up for patients with endometrial cancer ($n = 98$).

Age (y)	54 (24—78)
BMI (kg/m^2)	25.4 (18.0—44.0)
Categorical BMI	
<30	72 (73.4)
30—35	15 (15.4)
>35	11 (11.2)
Race	
Chinese	80 (81.6)
Malay	10 (10.2)
Indian	5 (5.1)
Other	3 (3.1)
Number of previous abdominal surgeries	
0	72 (73.5)
1	20 (20.4)
2	5 (5.1)
>2	1 (1.0)
Grade of tumor on final histology	
1	67 (68.3)
2	24 (24.6)
3	7 (7.1)
Stage of disease	
1	91 (92.9)
2	1 (1.0)
3	6 (6.1)
4	0 (0)
Histological subtypes	
Endometroid adenocarcinoma	90 (91.8)
Serous or clear cell carcinoma	3 (3.1)
Mixed patterns	4 (4.1)
Endometrial stroma sarcoma	1 (1.0)
Duration of follow up (mo)	19.7 (1.5—65.7)

Data are presented as *n* (%) or median (range).
BMI = body mass index.

baseline characteristics, demographics, disease pathology, and duration of follow up for each group of patients.

Table 3 gives the number of patients that underwent the various types of operation for the two types of cancer. A total of 91.8% of

Table 2
Baseline characteristics, disease pathology, and duration of follow up for patients with cervical cancer ($n = 44$).

Age (y)	47 (30—70)
BMI (kg/m^2)	24.1 (17.0—38.7)
Categorical BMI	
<30	39 (88.6)
30—35	4 (9.1)
>35	1 (2.3)
Race	
Chinese	35 (79.5)
Malay	6 (13.6)
Indian	2 (4.6)
Burmese	1 (2.3)
Number of previous abdominal surgeries	
0	35 (79.5)
1	9 (20.5)
Grade of tumor on final histology	
1	17 (38.6)
2	9 (20.5)
3	5 (11.4)
Ungraded	13 (29.5)
Stage of disease	
1A1	21 (47.7)
1A2	2 (4.6)
1B1	20 (45.5)
1B2	1 (2.3)
Histological subtypes	
Squamous	27 (61.4)
Adenocarcinoma	14 (31.8)
Mixed	3 (6.8)
Duration of follow up (mo)	28.6 (0.5—56.9)

Data are presented as *n* (%) or median (range).
BMI = body mass index.

Table 3
Type of laparoscopic surgery for each cancer group.

	n (%)
TLH+/− BSO BPLND	90 (91.8)
TLH+/− BSO BPLND PAND +/− omentectomy	6 (6.1)
Modified radical or radical hysterectomy BSO BPLND	2 (2.0)
TLH +/− BSO	25 (56.8)
Radical hysterectomy +/− BSO BPLND	17 (38.6)
Modified radical hysterectomy +/− BSO lymph node sampling	2 (4.6)

BPLND = bilateral pelvic lymphadenectomy; BSO = bilateral salpingo-oophorectomy; PAND = para-aortic lymphadenectomy; TLH = laparoscopic hysterectomy.

patients diagnosed with endometrial cancer underwent laparoscopic hysterectomy with or without bilateral salpingo-oophorectomy and bilateral pelvic lymphadenectomy. Five patients had an additional para-aortic lymphadenectomy and omentectomy for serous or clear cell endometrial cancers and two patients underwent radical hysterectomy for endometrial cancers with cervical involvement. For the group with cervical cancer, 56.8% of patients underwent laparoscopic hysterectomy with or without bilateral salpingo-oophorectomy for early stage 1A1 cervical cancer. The remaining patients (43.2%) with FIGO clinical stage 1A2 to 1B1 cervical cancer underwent modified radical or radical hysterectomy with or without bilateral salpingo-oophorectomy and bilateral pelvic lymph node dissection.

The perioperative data, postoperative course, and postoperative complications were analyzed based on the type of operation performed (hysterectomy versus radical hysterectomy) (Tables 4 and 5). One patient in the laparoscopic hysterectomy group was changed to a minilaparotomy as the specimen could not be delivered vaginally as a result of the patient's nulliparous status. Among the patients who underwent laparoscopic hysterectomy, only one patient had an intraoperative complication of serosal injury to the bladder and this was repaired immediately during the same operation. There was no intraoperative complication in the laparoscopic radical hysterectomy group. The majority of patients in both groups managed to successfully commence their diet of choice on the 2nd postoperative day and reported good pain control. Median pain scores were 2/10 at the 2-hour postoperative review and continued to decrease with

Table 4
Perioperative data, length of hospital stay, timing of first diet of choice, and pain score for patients.

Data	Hysterectomy ($n = 121$)	Radical hysterectomy ($n = 21$)
ORT (min)	190 (114—364)	273 (192—480)
EBL (mL)	93 (0—1200)	311 (0—850)
No. of lymph nodes removed	25 (3—47)	26 (0—49)
No. of conversions	1 (0.8)	0 (0)
Intraoperative visceral organ injury	1 (0.8)	0 (0)
Transfusions	1 (0.8)	1 (4.7)
LOS (d)	3 (2—27)	4 (3—16)
Median timing of first DOC (d)	2	2
Categorical timing of first DOC		
Day 1	23 (19.0)	0 (0)
Day 2	62 (51.2)	14 (66.7)
Day 3	31 (25.6)	6 (28.6)
Day 4 or later	5 (4.2)	1 (4.7)
Pain score after surgery		
2 h	2 (0—7)	2 (0—4)
6 h	1 (0—7)	1 (0—8)
12 h	1 (0—4)	1 (0—3)
24 h	1 (0—3)	1 (0—4)
48 h	0 (0—2)	1 (0—2)

Data are presented as n (%) or median (range).
DOC = diet of choice; EBL = estimated blood loss; LOS = length of stay in hospital; ORT = operating room time.

Table 5
Postoperative complications.

	Hysterectomy ($n = 121$)	Radical hysterectomy ($n = 21$)
Early (within 1 mo)		
Major		
Intestinal obstruction	1 (0.8)	0 (0)
Urinary tract injury	1 (0.8)	0 (0)
Vaginal vault bleeding	1 (0.8)	0 (0)
Fistula	0 (0)	1 (4.8)
Cardiovascular events	0 (0)	0 (0)
Venous thrombolic events	0 (0)	0 (0)
Minor		
Fever (>38.0°C)	3 (2.5)	1 (4.8)
Nausea and vomiting	4 (3.3)	0 (0)
Ileus	1 (0.8)	0 (0)
Infection, total	4 (3.3)	1 (4.8)
Skin	2 (1.7)	0 (0)
Upper respiratory tract	1 (0.8)	0 (0)
Urinary tract	1 (0.8)	1 (4.8)
Voiding dysfunction	3 (2.5)	4 (19.0)
Vault hematoma/dehiscence	1 (0.8)	0 (0)
Subcutaneous emphysema/ pneumomediastinum	0 (0)	0 (0)
Late (after 1 mo)		
Major		
Lymphoedema requiring surgery	1 (0.8)	0 (0)
Minor		
Lymphocyst/lymphatic leakage	2 (1.7)	2 (9.5)
Voiding dysfunction	3 (0.8)	4 (19.0)
Total patients with complications	15 (12.4)	6 (28.6)

Data are presented as n (%).

time. The median duration of hospital stay was 3 days for the hysterectomy group and 4 days for the radical hysterectomy group.

There were no perioperative deaths in the studied cohort. In terms of postoperative complications, 25 events occurred in 15 patients in the hysterectomy group. In two patients, a second operation was necessary. One patient underwent resuturing of the vaginal vault for persistent vaginal bleeding and the other needed a hernia repair for a port site hernia complicated by subacute intestinal obstruction. One patient was presumed to have sustained a transient ureteric injury as she was found on evaluation to have renal impairment associated with a new right-sided hydronephrosis. She was referred to a urologist and managed expectantly with restoration of normal renal function 1 month after the operation.

For the radical hysterectomy group, 13 events occurred in six patients. One complication was major and occurred in a patient who developed an uretero—vaginal fistula diagnosed 10 days postoperatively. She subsequently had a permanent DJ stent inserted. Her postoperative recovery was also complicated by problems of urinary tract infection, probably associated with the presence of the fistula.

In both groups, there were no cardiovascular events, pulmonary embolisms, deep vein thromboses, subcutaneous emphysema, or pneumomediastinum. The most common late complication in both groups was low-grade lymphedema managed conservatively with physiotherapy and compression stockings. This occurred in 12 patients in the hysterectomy group and four patients in the radical hysterectomy group. These patients were not included in the analysis of postoperative complications (Table 5) as they were grade 1 morbidities. However, one patient who underwent a laparoscopic hysterectomy for endometrial cancer developed lymphedema complicated by episodes of recurrent cellulitis, which required admission to hospital and treatment with intravenous antibiotics. She eventually underwent surgery and had vascularized lymph node transfer for treatment of her lymphedema.

Table 6
Laparoscopic outcomes in randomized prospective studies and systematic reviews for laparoscopic hysterectomies.

Reference	n	ORT (min)	LOS (d)	EBL (mL)	No. of LN removed	Conversion rate (%)	Intraoperative complications (%)	Postoperative complications (%)	Recurrence rate (%)
Walker et al[7]	1696	204	2	NR	17	25.8	10	14	11.6
Mourits et al[13]	185	115	3	100	NR	10.8	5	11.9	NR
Malzoni et al[14]	81	136	2.1	50	23.5	0	NR	NR	8.6
Magrina et al[15]	945	171	3.5	216	16.2	1.8	4.2	12.2	8.6
Zullo et al[16]	40	197	3	174	11.5	12.5	7.5	27.5	22.5
Tozzi et al[17]	63	NR	7.8	241	28.6	7.9	4.7	31.7	12.6
Our institution	121	190	3	93	25	0.8	0.8	12.4	4.1

EBL = estimated blood loss; LN = lymph node; LOS = length of stay in hospital; NR = not reported; ORT = operating room time.

The rates of recurrence of cancer in the hysterectomy and radical hysterectomy groups were 4.1% and 14.2%, respectively. In the hysterectomy group, one patient with a port site recurrence was reported. This patient had undergone laparoscopic hysterectomy, bilateral salpingo-oophorectomy, pelvic lymph node dissection, and postoperative radiotherapy for stage 1b grade 1 endometroid adenocarcinoma of the endometrium. Her cancer recurred 28 months later in the form of port site metastasis and she is currently receiving treatment with Megace. The other sites of recurrence in the hysterectomy group included the pelvic lymph nodes, lungs, and vaginal vault. The sites of recurrence in the radical hysterectomy group included the vaginal vault, peritoneum, pelvic side walls, and liver.

The survival rate for the patients with endometrial cancer was 100% with a median duration of follow up of 23 months (Table 2), with six patients being lost to follow up. One patient in the cervical cancer group died 2 years and 3 months after her operation. She was initially diagnosed with stage 1b1 cervical cancer and was disease-free for 14 months before she had a recurrence of the cancer in the liver and peritoneum.

Discussion

The use of laparoscopy in endometrial and cervical cancer surgery was first proposed in the 1990s and, since then, several randomized trials and meta-analyses have provided evidence that supports the use of laparoscopic-assisted surgery over traditional open surgery for early stage gynecological cancers. The first laparoscopic operation for gynecological cancer was performed in our institution in the year 2000. Since then, the practice of minimally invasive surgery for these cancers has become more commonplace in our institution for suitable patients, with a background of appropriate patient selection.

With specific attention to endometrial and cervical cancers, multiple randomized trials have been performed comparing the morbidity of a laparoscopic approach versus a conventional laparotomy approach. Tables 6 and 7 give the perioperative and morbidity outcomes for laparoscopic surgery in some of these studies. The results of our study are included in the tables for comparison.

In terms of operating time, length of hospital stay, and lymph node yield, results from laparoscopic hysterectomy and radical hysterectomy were comparable with those of other institutions. The estimated blood loss and positive margin status in the radical hysterectomy group were higher than at other institutions. Although the results may be skewed due to our relatively small sample size, a possible contributory factor could be the steeper learning curve for surgeons performing a laparoscopic radical hysterectomy compared with a laparoscopic hysterectomy.

Intraoperative complications were low in our study, with only one patient sustaining a visceral organ injury (serosal injury to the bladder), which was repaired promptly during the same operation. Only one patient required conversion to a minilaparotomy because the hysterectomy specimen was unable to be delivered vaginally as a result of her nulliparous status. This low rate of conversion of 0.80%, which is much lower than that reported previously, is probably a result of the stringent patient selection criteria within our institution. In addition, differences in patient demographics may also contribute to these differences in conversion rates, in particular with regard to the body mass index (BMI). In our study, the median BMI was 25.4 and 24.1 for endometrial and cervical cancer, respectively. This compares with a slightly higher median BMI in Western series, ranging from 26 to 28, which may, in some patients, impede safe completion of the operation via a laparoscopic approach.

The total postoperative complication rates at our center were 12.4% and 28.6% for the hysterectomy and radical hysterectomy groups, respectively. This is largely comparable with those published previously. Most of the postoperative complications in the radical hysterectomy group were attributed to voiding dysfunction, which occurred in four (19%) patients. Although this appears to be a large proportion, the value is at the lower range of that expected in an open radical hysterectomy, where the incidence of voiding dysfunction ranges from 20% to 50%.[9,10]

Concerns remain regarding the adequacy of oncological clearance with minimally invasive techniques compared with open surgery and whether the laparoscopic approach affects recurrence and survival rates. The LAP2 study aimed to look at this issue.[6] In this study, 2616 women were randomized to either laparoscopy (*n* = 1696) or laparotomy (*n* = 920) for endometrial

Table 7
Laparoscopic outcomes in randomized prospective studies and systematic reviews for laparoscopic radical hysterectomy.

Reference	n	ORT (min)	LOS (d)	EBL (mL)	No. of LN removed	Conversion rate (%)	Intraoperative complications (%)	Postoperative complications (%)	Positive/close margins (%)	Recurrence rate (%)
Geetha and Nair[18]	1339	264	3.8	209	21.6	NR	NR	15	0	2.8
Pellegrino et al[19]	107	305	4	200	26	5.6	1.9	22.4	8.4	14.1
Magrina et al[20]	31	216	2	208	25	0	3	19.3	NR	NR
Spirtos et al[21]	78	205	NR	225	34.1	3.8	5.1	26.2	3.84	10.3
Our institution	21	273	4	311	26	0	0	28.6	9.5	14.2

EBL = estimated blood loss; LN = lymph node; LOS = length of stay in hospital; NR = not reported; ORT = operating room time.

cancer surgery. All women had a total hysterectomy, bilateral salpingo-oophorectomy, and pelvic/para-aortic lymphadenectomy. The main study endpoint was noninferiority for recurrence-free survival. The results from the study showed 3-year recurrences rate of 11.4% and 10.2% in the laparoscopic and laparotomy group, respectively. The estimated 5-year overall survival was almost identical at 89.8% in both groups. This study thus concluded that laparoscopic surgery was not inferior to laparotomy in terms of recurrence and survival rates. At our institution, the overall survival rate was 100% with a 5% rate of cancer recurrence to date. However, the median duration of follow up in our study is only approximately 2 years. This precludes meaningful comparison of our findings with other studies. Efforts are ongoing to continue collecting data to further analyze the outcomes and survival rates when an adequate duration of follow up has been achieved.

Many retrospective series have addressed the concerning issue of port site metastases in women undergoing laparoscopic procedures for gynecological cancers. However, the true incidence of this complication is unknown. A 12-year study of 1288 patients who underwent minimally invasive surgery for gynecological cancers found a port site metastasis rate of 0.97%.[11] However, these patients had gynecological cancers that included not only endometrial and cervical cancers, but also ovarian cancers. Another retrospective study of 105 laparoscopic operations for gynecological cancers found a similar rate of 1% for abdominal wall tumor implantation.[12] As the incidence of this complication is low, it is difficult to draw conclusive results from the various published reports. In our retrospective study, we saw one patient with port site metastasis among the 142 patients who underwent laparoscopic surgery for gynecological cancer, giving a rate of 0.7%, which is consistent with the low rate of this particular complication observed in previously published reports.

Conclusion

To our knowledge, this is one of only a few studies in Singapore looking at the outcomes and complication rates of laparoscopic surgery for gynecological cancers. It appears that this approach to surgery for endometrial and cervical cancers in our institution is safe, with morbidity rates and outcomes comparable with data published previously by other centers. In the setting of good patient selection, it is a technique which should be considered as part of the surgical armamentarium of a gyne-oncologist for the surgical treatment of cervical and endometrial cancers.

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