

A Review of Laparoscopic Para-aortic Lymphadenectomy for Early-stage Endometrial Cancer: Extraperitoneal Approach May Have the Advantage over Intraperitoneal Approach

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Abstract

The importance of lymphadenectomy, including para-aortic nodes, for the accurate staging of endometrial cancer, is well established. Although the therapeutic role of lymph node resection in endometrial cancer is still under debate, some studies support its usefulness for survival benefit. To predict the necessity of lymphadenectomy, several preoperative scoring systems have been proposed as being effective. For endometrial cancer, there is a trend towards minimally invasive surgery, including para-aortic lymphadenectomy. For para-aortic lymphadenectomy, there are two different approaches: the extraperitoneal approach and the transperitoneal approach. The extraperitoneal approach has advantages over the transperitoneal approach in terms of better access to the left aortic nodes, no interference of the bowel, and possibly better options for obese or elderly patients. However, the extraperitoneal approach may have a longer learning curve than the transperitoneal approach. Robot-assisted extraperitoneal para-aortic lymphadenectomy is feasible and safe and may be suitable for patients irrespective of their baseline characteristics.

Keywords: Endometrial cancer, extraperitoneal method, laparoscopic surgery, minimally invasive surgery, para-aortic lymphadenectomy

INTRODUCTION

Endometrial cancer is the most common malignancy of the female genital tract. The National Comprehensive Cancer Network (NCCN) has stated in the principles of evaluation and surgical staging that total hysterectomy, bilateral salpingo-oophorectomy, and lymph node assessment are the primary treatments for apparent uterine-confined endometrial cancer.^[1] In 2017, 67% of patients with endometrial cancer had disease confined to the uterus at diagnosis.^[1] Lymph node metastasis (LNM) is a major risk factor for the recurrence and metastasis of endometrial cancer,^[2] and para-aortic and pelvic LNMs have been observed in 5% and 9% of endometrial cancer patients, respectively.^[3] Recently, there has been a trend toward minimally invasive surgery for endometrial cancer, including para-aortic lymphadenectomy.^[4-6] There

are two approaches for para-aortic lymphadenectomy: the extraperitoneal approach and the transperitoneal approach. Laparoscopic extraperitoneal para-aortic lymphadenectomy was first described by Dargent *et al.*^[7] in 2000. Moreover, Andou reported total extraperitoneal lymphadenectomy as a patient-friendly and safe procedure by eliminating the bowel from the operative field.^[8] Many reports have compared extraperitoneal para-aortic lymphadenectomy to transperitoneal procedures; however, there are still many controversial opinions. This review was conducted to determine the significance of laparoscopic extraperitoneal lymphadenectomy for early-stage endometrial cancer.

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Significance of para-aortic lymphadenectomy for the management of endometrial cancer

The importance of para-aortic lymphadenectomy for the accurate staging of endometrial cancer is well established. Metastasis to the para-aortic lymph node is an important factor that affects the prognosis of endometrial cancer.^[9] Seracchioli *et al.* stated that complete surgical staging, including lymphadenectomy, is the gold standard for evaluating lymph node involvement, which is the most common site of extrauterine spread of endometrial cancer.^[10] In 2006, the American Congress of Obstetricians and Gynecologists recommended surgical staging, including lymph node sampling, for most women with endometrial cancer, except for young women desiring fertility preservation and women at an increased risk of mortality secondary to comorbidities.^[11] To estimate the overall survival (OS) of patients with endometrial cancer, AlHilli *et al.* examined 1,281 patients. Among the 925 low-risk patients (International Federation of Gynecology and Obstetrics [FIGO] grade 1 or 2 endometrioid histology), the following variables were independently predictive of compromised OS: older age at surgery, cardiovascular disease, pulmonary dysfunction, advanced stage, primary tumor diameter >2 cm, pelvic lymph node status, and 30-day postoperative complications.^[12] FIGO revised stage IIIC by dividing it into two subgroups: stage IIIC1 is diagnosed when the pelvic lymph nodes are involved and stage IIIC2 is diagnosed when the para-aortic lymph nodes are involved. This was changed according to the evidence that the prognosis is worse with involvement of the para-aortic nodes than of the pelvic nodes.^[13]

However, the therapeutic significance of lymphadenectomy for endometrial cancer remains controversial. In a randomized controlled trial of women with histologically proven endometrial cancer that was thought preoperatively to be confined to the corpus, no benefit was shown in terms of overall or recurrence-free survival for pelvic lymphadenectomy.^[14,15] From these results, the Cochrane Library reported no evidence of lymphadenectomy decreasing the risk of death or disease recurrence compared with no lymphadenectomy in women with presumed stage I disease.^[16] They also reported that no randomized controlled trials looked at differences between pelvic and para-aortic lymph node removal. Therefore, it is not known whether pelvic and para-aortic lymph node dissection confers any benefit over pelvic lymphadenectomy alone.^[16]

In a study examining the therapeutic role of lymph node resection in endometrial cancer (pelvic, para-aortic, or both), more extensive lymph node resection was associated with improved 5-year disease-specific survival. However, no significant benefit of lymph node resection could be

demonstrated in low-risk patients.^[17] Cragun *et al.* studied 373 patients with clinical stage I endometrial cancer who underwent selective pelvic and para-aortic lymphadenectomy. The median number of lymph nodes removed was 15; the median number of pelvic nodes removed was 11; and the median number of para-aortic nodes removed was three. The rates of pelvic and para-aortic lymph node metastases were 5% and 3%, respectively. They found that more extensive selective lymphadenectomy (>11 pelvic lymph nodes) was associated with improved survival in women with grade 3 cancers without gross evidence of metastatic endometrial cancer at the time of hysterectomy.^[18] Seagle *et al.* reported that the performance of pelvic lymphadenectomy was associated with increased survival compared with no lymphadenectomy, and the addition of para-aortic lymphadenectomy was associated with increased survival compared with pelvic lymphadenectomy alone in stage I endometrioid endometrial cancer according to matched cohort analyses from the National Cancer Database of the United States.^[19] In addition, they also analyzed the association between lymph node count and OS in node-negative endometrial cancers and showed that an increased number of resected nodes tended to improve OS in each stage.^[19,20] Papatthemelis *et al.* retrospectively evaluated OS, recurrence rates, and recurrence-free survival among patients with high-grade type I and II endometrial cancer who underwent pelvic and para-aortic lymph node dissection. They observed significantly increased OS in patients who underwent systematic dissection of 25 or more para-aortic and pelvic lymph nodes versus patients who did not undergo such an intervention or patients who underwent elective dissection of 1–24 lymph nodes in both univariable and multivariable analyses.^[21] Recently, a systematic review and meta-analysis was performed to assess the impact of combined pelvic and para-aortic lymph node dissection compared to only pelvic lymph node dissection on the survival outcomes of intermediate- and/or high-risk patients in 13 studies that included 7,349 patients. Although all studies were retrospective observations, combined pelvic and para-aortic lymphadenectomy was associated with a 46% decreased risk of death and 49% decreased risk of recurrence.^[22] Therefore, para-aortic lymph node dissection may play a therapeutic role in treating endometrial cancer patients, and the number of dissected lymph nodes might be important for the prognosis of patients with high-risk endometrial cancer.

Preoperative scoring system to predict lymph node metastasis

Accurate preoperative evaluations for stage IA endometrial cancer are not generally easy. Terada *et al.* studied 108 endometrial cancer patients who were suspected to be stage IA and underwent laparoscopic- or robot-assisted surgery. When they compared preoperative imaging evaluation results

and postoperative histopathological observations, 98 out of 108 patients were diagnosed accurately.^[23] Chikazawa *et al.* reported that volume index which was evaluated by magnetic resonance imaging (MRI) can be a recurrence predictor in clinical stage IA endometrial cancer patients.^[24]

It is important to predict the necessity of lymphadenectomy preoperatively because lymphadenectomy prolongs the surgery duration and increases intraoperative bleeding, postoperative complications, and the cost of care.^[25]

It is reported that lymphadenectomy could be resulted in severe complications such as elephant leg.^[26]

Mariani *et al.* examined 328 patients with endometrioid cancer and reported that grade 1 or 2 endometrioid cancer with $\leq 50\%$ myometrial invasion, tumor size ≤ 2 cm, and no intraoperative evidence of macroscopic disease can be treated optimally with hysterectomy alone.^[27] Since then, three preoperative scoring systems have been reported.^[28-32] The scoring system of Todo *et al.* comprised three factors: preoperative histological examination: type/grade, preoperative serum CA125 level, and the volume index representing tumor volume evaluated with MRI. For CA125, two cutoff values (28 U/mL for patients aged >50 years and 70 U/mL for patients aged ≤ 50 years) were used to divide patients into low- and high-CA125 groups for pelvic LNM.^[28,29] When they divided 211 patients with endometrial cancer into four risk groups (low, intermediate, high, and extremely high), para-aortic LNM was found in 1.0% of the low-risk group. They concluded that para-aortic lymphadenectomy may not be necessary in low-risk patients.^[29] Furthermore, they evaluated 262 patients with endometrial cancer with a LNM score generated by adding myometrial invasion and extrauterine spread assessed by MRI. As a result, 51 patients underwent surgery without lymphadenectomy, with an OS rate of 100%. They stated that the LNM score alone may not be sufficient and that the combination of the LNM score and myometrial invasion with preoperative MRI is useful.^[33] Kang *et al.* assessed the risk of LNM in patients with endometrial cancer with endometrioid histology. When they defined the low-risk group as patients who did not have any of the following parameters: deep myometrial invasion on MRI, enlarged lymph nodes on MRI, extension beyond the uterine corpus on MRI, and CA125 >35 IU/mL, 175 out of 330 patients were categorized into the low-risk group. In this group, metastasis was observed in three patients (3/175, 1.7%).^[30] They further analyzed 272 patients who were categorized into the low-risk group using the same criteria among 529 patients. Eight patients (2.9%) out of 272 patients had LNM, and the criteria were confirmed to be reliable and accurate for identifying parameters for low risk of LNM.^[31] Imai *et al.* studied 432 patients with FIGO stage I–III endometrial cancer using

a scoring system with four criteria: tumor volume >6 cm³, myometrial invasion $>50\%$, histological type other than G1 endometrioid cancer, CA125 >70 U/ml for premenopausal women, and >25 U/ml for menopausal women. When lymphadenectomy was omitted in the group that showed negative results for all four criteria, they found that only one of the 118 patients had recurrence. Therefore, they concluded that their scoring system would be a clinically valid tool for preoperative patient stratification for surgery.^[32] Overall, all these systems were shown to be good indicators of when to omit lymphadenectomy.^[20]

Minimally invasive surgery for endometrial cancer

Recently, a minimally invasive approach has been selected over conventional laparotomy because it has advantages such as shorter hospital stay, fewer blood loss, faster recovery, less pain, less scarring, and a faster return of bowel function with equivalent assessment of lymph node status.^[6,34,35] Janda *et al.* showed that patients who underwent laparoscopic surgery had oncologic survival outcomes similar to those who underwent laparotomy for early-stage endometrial cancer.^[36] Wright *et al.* compared patients with stage I–III endometrial cancer who underwent abdominal hysterectomy with those who underwent minimally invasive hysterectomy (laparoscopic and robot-assisted). They found that minimally invasive hysterectomy was associated with a lower overall complication rate and lower perioperative mortality. There was no association between the use of minimally invasive hysterectomy and either overall or cancer-specific mortality. They also found that the performance of minimally invasive hysterectomy for endometrial cancer increased from 9.3% in 2006 to 61.7% in 2011.^[37] Casarin *et al.* retrospectively analyzed 12,283 patients who had undergone surgery for early-stage endometrial cancer and found that minimally invasive surgery is associated with substantial decreases in 30-day morbidity, readmission, and reoperation. They also found a significant implementation of minimally invasive surgery (24.2%–71.4%) and a concomitant decrease in open surgery through laparotomy (71.1%–26.4%) from 2008 to 2014.^[6] In a Japanese study of patients with stage IA endometrial cancer, laparoscopic surgery has been reported to result in less intraoperative blood loss and a shorter hospital stay than laparotomy. The operative time was significantly longer for laparoscopic surgery than for laparotomy, but this difference was not observed in obese patients with a body mass index (BMI) ≥ 30 kg/m². The type of surgical procedure did not affect the incidence of perioperative complications. They concluded that laparoscopic staging surgery is a feasible and safe alternative to laparotomy for patients with presumed low-risk endometrial cancer, especially for obese patients.^[38] In studies of morbidly obese patients with endometrial cancer (BMI ≥ 40 kg/m²), minimally invasive

surgeries were associated with fewer complications and fewer days of hospitalization relative to open surgery.^[39,40] According to nine randomized controlled trials (1361 laparotomies and 2255 laparoscopies for endometrial cancer) that included all stages of endometrial cancer, there was no significant difference between the laparoscopic and laparotomic approaches in terms of the 3-year OS, 3-year disease-free survival, recurrence at the 3-year follow-up, or pelvic node yield. The benefits of laparoscopic surgery compared with laparotomy were a shorter length of hospital stay and lower rates of postoperative complications. The disadvantages were higher rates of intraoperative complications and longer durations of surgical procedures.^[41] Similar favorable observations of laparoscopic surgery for endometrial cancer were reported from India and Malaysia.^[42,43]

Tanaka *et al.* retrospectively compared 54 patients in the laparoscopic group and 99 patients in the laparotomic group who underwent systematic para-aortic lymphadenectomy for endometrial cancer. They found that the mean operative time, rates of intraoperative complications, and recurrence rates were not significantly different between the groups. The laparoscopic group had less intraoperative blood loss, shorter hospital stays, and a lower postoperative maximum level of C-reactive protein. The number of dissected pelvic lymph nodes and para-aortic lymph nodes was lower in the laparoscopic group than in the laparotomic group.^[34] Another retrospective study of patients with intermediate- and high-risk endometrial cancer compared 110 patients who underwent laparoscopic surgery with 309 patients who underwent open surgery. Better OS was observed following laparoscopic surgery. However, no statistically significant difference was observed in recurrence-free survival.^[44] Therefore, the NCCN guidelines stated that minimally invasive techniques are preferred due to a lower rate of surgical site infection, transfusion, venous thromboembolism, decreased hospital stay, and lower cost of care, without compromising oncologic outcomes.^[1]

Evidence for the use of minimally invasive surgery in early-stage endometrial cancer and patients with low risk for recurrence is relatively well established; however, limited data are available on the feasibility and safety of the laparoscopic management of endometrial cancer with high-risk factors such as advanced-stage and type II histology.^[5] Fader *et al.* compared 191 patients who underwent laparotomy to 192 patients who underwent minimally invasive surgery (65% robotic, 35% laparoscopy) with high-grade endometrial cancer. They found that women with high-grade endometrial cancers staged with minimally invasive techniques experienced fewer complications and similar survival outcomes compared to those staged by laparotomy.^[45] Similar results were reported by Monterossi

et al.^[46] Favero *et al.* analyzed 53 women who underwent laparoscopy and 36 who underwent laparotomy with serous or clear cell endometrial cancer without peritoneal carcinomatosis. Procedures included hysterectomy, bilateral salpingo-oophorectomy, omentectomy, and pelvic and para-aortic lymphadenectomy. They concluded that laparoscopy is, oncologically at least, not inferior to laparotomy for the surgical treatment of type II endometrial cancer. Moreover, the endoscopic techniques are feasible and effective and result in significantly less morbidity and improved quality of staging.^[47]

Comparison of two different approaches for para-aortic lymphadenectomy

There are two different approaches for para-aortic lymphadenectomy: the extraperitoneal approach and the transperitoneal approach. The transperitoneal approach is more common because of a familiar surgical field with great working space; however, the extraperitoneal approach has a lower adhesion rate and better surgical field to remove lymph nodes.^[48] The procedure for extraperitoneal para-aortic lymphadenectomy has been described previously.^[49] Briefly, the patient is placed in a supine position, and a 12-mm trocar is inserted into the peritoneal cavity through an incision made in the umbilical site. After inspection of the peritoneal cavity, a skin incision is made medial to the left anterior iliac spine in the midclavicular line, and a 12-mm trocar is placed into the incision. The extraperitoneal space is prepared while taking care to prevent peritoneal rupture, followed by insufflation of CO₂. Under endoscopic observation of the retroperitoneal space, the second (5 mm), third (5 mm), and fourth (12 mm) ports are placed. The retroperitoneal cavity is widened to expose the aortic bifurcation, vena cava, and left renal vein. Lymphadenectomy is started from the left side of the aortic bifurcation followed by the sacral area, the right side of the vena cava, and the area between the aorta and vena cava. The removed lymph nodes were placed in plastic bags and collected through the vagina.^[49,50] The positions of the torch and a final view of the procedure are shown in Figures 1 and 2.

A systematic review and meta-analysis was performed to compare transperitoneal and extraperitoneal laparoscopic lymphadenectomy in articles published up to April 2018. A total of 7 studies (1 randomized control trial and 6 retrospective studies) which included 608 patients were analyzed. The extraperitoneal approach was associated with significantly shorter operative times for lymphadenectomy, whereas the total operative times were not significantly different between the two groups. Significantly increased intraoperative complications were observed with the transperitoneal approach. No significant differences were observed in terms of blood loss, blood transfusion rates, postoperative complications, or the length of hospital stay.

The mean number of resected lymph nodes did not differ between the pelvic nodes and para-aortic nodes.^[51] The researchers also mentioned that the extraperitoneal approach is especially useful in obese patients because of the avoidance of the thick mesenteric adipose tissues of the small bowel and colon from the surgical field.^[51,52] Iavazzo and Gkegkes also pointed out that the extraperitoneal approach is useful for obese or elderly patients with comorbidities because it can reduce the necessity of extreme Trendelenburg positioning.^[53] More recently, Díaz-Feijoo *et al.*^[54] performed a prospective randomized multicenter study of 203 patients with early endometrial or ovarian cancer undergoing para-aortic lymphadenectomy. In terms of surgical and oncological parameters, the extraperitoneal approach did not show significant differences compared with the transperitoneal approach, although the number of aortic nodes retrieved was higher.

Zang *et al.* reported that higher numbers of para-aortic nodes were harvested with the extraperitoneal approach than with the transperitoneal approach. They speculated that this is because the left-sided extraperitoneal technique provides easier access to the left aortic nodes, which account for 63% of all aortic nodes.^[55] Capozzi *et al.* carried out a systematic review and meta-analysis of 19 studies and 1112 patients who underwent either transperitoneal laparoscopic lymphadenectomy or extraperitoneal laparoscopic lymphadenectomy for locally advanced cervical cancer. The results revealed that the overall complication (intraoperative and postoperative) rate did not show a significant difference between the two groups; however, a significantly higher intraoperative complication rate was seen in the transperitoneal group compared to the extraperitoneal group. No significant differences were found between the groups in terms of the estimated blood loss,

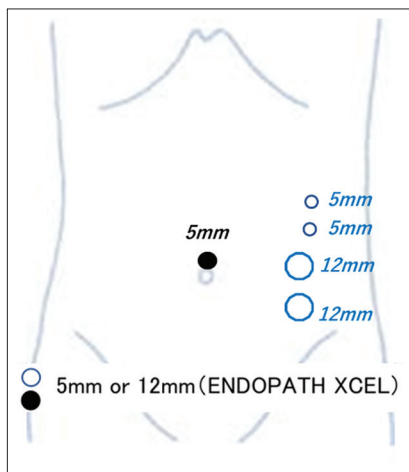


Figure 1: Trocar position for laparoscopic extraperitoneal para-aortic lymphadenectomy. The first trocar is placed medial to the left anterior iliac spine in the midclavicular line followed by the second (5 mm), third (5 mm), and fourth (12 mm) ports

length of stay, intraoperative time, conversion to laparotomy rate, number of lymph nodes excised, or postoperative complications.^[56] Therefore, the extraperitoneal approach may have some advantages over the transperitoneal approach because it has the following benefits: it provides more secure access to the left aortic nodes, the bowel does not interfere with the surgical field, it reduces the risk of injury to the left ureter, and it eliminates the risk of postoperative abdominal hernia and intra-abdominal adhesions.^[51] The possible differences between the two procedures are shown in Table 1.

Comparison of the learning curve for laparoscopic para-aortic lymphadenectomy

The extraperitoneal approach was suggested to be associated with a longer learning curve.^[51] Regarding the learning curves of both procedures, Occelli *et al.* reported that they stabilized after the tenth procedure for each approach in terms of the duration of the procedure, the number of lymph nodes removed, and the number of residual nodes in a study using pigs. They also reported that the efficacy and operative morbidity were comparable between the two procedures.^[57] Dowdy *et al.* reported that extraperitoneal laparoscopic para-aortic lymphadenectomy is an easily learned technique. They harvested 16.5% of the para-aortic lymph nodes using

Table 1: Possible difference of para-aortic lymphadenectomy between extraperitoneal and transperitoneal approaches

	Extraperitoneal	Transperitoneal
Operative time for lymphadenectomy	Short	Long
Intraoperative complications	Less	More
Blood loss	Even	Even
Postoperative complications	Even	Even
Hospital stay length	Even	Even
Number of resected nodes	Even	Even
Access to the left aortic node	Better	Worse
Access to the right caval node	Worse	Better
Interference of bowel	Negative	Positive
For obese or elderly patients	Suitable	Not so suitable
Learning curve	Long	Short

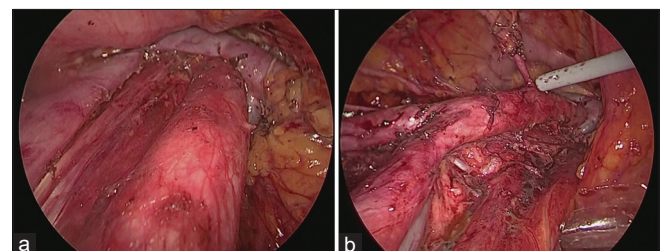


Figure 2: Final view of laparoscopic extraperitoneal para-aortic lymphadenectomy: (a) Right side of vena cava and the area between the aorta and vena cava, (b) Left side of the aorta, common iliac artery, and sacral area

laparoscopic surgery.^[58] On the other hand, Köhler *et al.* reported that a constant number of pelvic lymph nodes were removed after a learning period of approximately 20 procedures; however, they also reported that the number of removed para-aortic lymph nodes increased continuously from 5.5 to 18.5.^[59] Recently, Yoshida *et al.* examined the learning curve for laparoscopic extraperitoneal para-aortic lymphadenectomy by using cumulative sum analysis and retrospectively analyzing 134 patients with early-stage endometrial cancer. They found that the technique for the average removal of sufficient lymph nodes was established around the 50th case, and the procedure time reached the average from around the 60th case and then shortened. Because the number of harvested para-aortic lymph nodes was 65.3, which was far higher than that reported by Dowdy *et al.* and Köhler *et al.*, they speculated that a higher number of harvested lymph nodes would be expected if other studies had longer observation periods.^[49] In an ongoing Japanese study, three regulations were defined to assure the quality of lymphadenectomy as follows: board-certified surgeons should be responsible for all procedures, the lower limit of the number of resected nodes was defined (25 in the pelvic region, 15 in the para-aortic region), and photos should be taken of the entire dissected area after lymphadenectomy completion. From the latest report of the study, the median number of resected nodes was 43 in the pelvic region and 26 in para-aortic region in the pelvic and para-aortic lymphadenectomy arms.^[20] It is difficult to say how many resected nodes could be judged to be through lymphadenectomy. It also seems to be difficult to reach a conclusion about the learning curve of para-aortic lymphadenectomy because of conflicting data; however, laparoscopic extraperitoneal lymphadenectomy may require a long learning curve.

Robot-assisted extraperitoneal para-aortic lymphadenectomy

Robot-assisted extraperitoneal para-aortic lymphadenectomy was first reported in 2009 by Magrina *et al.*^[60] Since then, there have been many reports showing the feasibility and safety of this procedure.^[61-64] The most reported complication associated with extraperitoneal para-aortic lymphadenectomy is postoperative lymphocyst formation. Da Costa *et al.* studied 21 patients with gynecologic cancer who underwent extraperitoneal para-aortic lymphadenectomy via robot-assisted laparoscopy and reported that three patients were readmitted for symptomatic lymphocysts. They concluded that perforation of the peritoneum and symptomatic lymphocysts are a postoperative concern.^[65] Narducci *et al.* studied 30 patients who underwent extraperitoneal para-aortic lymphadenectomy via robot-assisted laparoscopy in gynecologic oncology and found seven patients who had lymphocysts treated by computed tomographic-guided

drainage. They mentioned that marsupialization could be useful in decreasing the risk of lymphocysts.^[66] Moreover, Bebia *et al.* analyzed 203 patients with early endometrial or ovarian cancer who underwent para-aortic lymphadenectomy who were randomized to undergo minimally invasive surgery (laparoscopic or robotic-assisted) using an extraperitoneal or transperitoneal approach; 68 patients were in the extraperitoneal laparoscopic group, 62 were in the transperitoneal laparoscopic group, 35 were in the extraperitoneal robotic group, and 38 were in the transperitoneal robotic group. They found that robot-assisted extraperitoneal para-aortic lymphadenectomy was associated with fewer surgical complications, even in older patients with a high BMI or waist-to-hip ratio without compromising lymph node retrieval, operative time, or length of stay.^[67] They mentioned that a peritoneal opening at the end of the extraperitoneal procedure drastically diminished the likelihood of lymphocyst formation.^[68] The advantages of robotic surgery include enhanced visualization in narrow surgical fields, surgeon ergonomics, hemostatic precision, three-dimensional vision, the absence of tremor, and fatigue reduction during surgery.^[67] They also reported that the BMI and waist-to-hip ratio were independent prognostic factors for the development of complications during para-aortic lymphadenectomy. Gehrig *et al.* examined obese (BMI 30–39.9) and morbidly obese (BMI \geq 40) patients with endometrial cancer who underwent either robotic or laparoscopic surgery, including para-aortic lymphadenectomy.^[69] When they compared 36 obese and 13 morbidly obese women who underwent robotic surgery to 25 obese and 7 morbidly obese women who underwent laparoscopic surgery, they found that robotic surgery was associated with a shorter operative time, less blood loss, increased lymph node retrieval, and a shorter hospital stay.^[69] Yanai *et al.* reported that total extraperitoneal lymphadenectomy via robot-assisted surgery may be suitable for patients with hypertension, glaucoma, obesity, or abdominal adhesions because it does not require the Trendelenburg position and the bowel does not obstruct the surgical field.^[70] Therefore, robot-assisted extraperitoneal para-aortic lymphadenectomy may be suitable for patients irrespective of their baseline characteristics.^[67]

CONCLUSIONS

Lymph node dissection can be used to identify patients who require adjuvant treatment with radiation therapy and/or systemic therapy. A subset of patients may not benefit from lymphadenectomy; however, preoperative identification of these patients is difficult.^[1] Para-aortic lymphadenectomy may be useful to avoid recurrence in patients with high-risk endometrial cancer, especially when relatively large numbers of nodes are dissected. To predict the necessity of

lymphadenectomy, a preoperative scoring system may be useful. Minimally invasive para-aortic lymphadenectomy is feasible and safe, with oncologic outcomes comparable with those of open surgery. The extraperitoneal approach may have advantages over the transperitoneal approach, especially for obese patients; however, the surgeon may require a relatively long learning curve for this technique. Finally, robot-assisted para-aortic lymphadenectomy may be advantageous for patients irrespective of their baseline characteristics.

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Conflicts of interest

There are no conflicts of interest.

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