HHS Public Access

Author manuscript

Am J Obstet Gynecol. Author manuscript; available in PMC 2024 September 11.

Published in final edited form as:

Am J Obstet Gynecol. 2019 March ; 220(3): 263.e1–263.e8. doi:10.1016/j.ajog.2018.11.1102.

Extent of Lymphadenectomy and Postoperative Major Complications Among Women with Endometrial Cancer Treated with Minimally Invasive Surgery

Rosa M. POLAN, MD[1], **Emma C. ROSSI, MD**[2], **Emma L. BARBER, MD, MS**[1,3,4]

[1]Northwestern University, Division of Gynecologic Oncology, Department of Obstetrics and Gynecology, Chicago, IL, USA.

[2]University of North Carolina, Division of Gynecologic Oncology, Department of Obstetrics and Gynecology, Chapel Hill, NC, USA.

[3]Robert H Lurie Comprehensive Cancer Center, Northwestern University, Chicago, IL.

[4]Center for Healthcare Studies, Institute for Public Health in Medicine, Chicago, IL.

Abstract

Background: In patients with endometrial cancer sentinel lymphadenectomy is used to accurately prognosticate extent of disease and has been proposed as a method to decrease the incidence of medical and surgical complications associated with more extensive lymphadenectomy. It is unknown if patients who undergo traditional lymphadenectomy experience major postoperative complications at the same rates as those who undergo sentinel lymphadenectomy or those who do not undergo lymphadenectomy.

Objective: To compare the incidence of major postoperative complications among endometrial cancer patients undergoing total laparoscopic hysterectomy with traditional lymphadenectomy versus sentinel or no lymphadenectomy.

Study Design: Patients with endometrial cancer who underwent total laparoscopic hysterectomy recorded in the National Surgical Quality Improvement Program (NSQIP) database 2015–2016 were identified using current procedural terminology (CPT) and international classification of diseases (ICD) codes. Primary exposure was extent of lymphadenectomy. Primary outcome was

Corresponding author: Rosa Miller Polan, MD, Department of Obstetrics and Gynecology, Northwestern University, 250 East Superior Street, Suite #5-2177 Chicago, IL, 60611; Fax: 312-472-4687, rosa.polan@northwestern.edu.

Conflicts of interest: The authors declare no potential conflicts of interest.

NSQIP disclosure: American College of Surgeons National Surgical Quality Improvement Program and the hospitals participating in the ACS NSQIP are the source of the data used herein; they have not verified and are not responsible for the statistical validity of the data analysis or the conclusions derived by the authors.

Condensed Title: Extent of Lymphadenectomy in Endometrial Cancer and Postoperative Complications

Endometrial cancer patients treated with laparoscopic hysterectomy and sentinel lymphadenectomy have reduced risk of postoperative major complications and need for readmission compared with traditional lymphadenectomy.

major postoperative complications as defined by the Clavien-Dindo scale. Associations were examined with bivariable tests and multivariable logistic regression.

Results: 3,282 women with endometrial cancer who underwent total laparoscopic hysterectomy were identified; 2,049 (62.4%) did not undergo lymphadenectomy, 1,089 (33.2%) underwent traditional lymphadenectomy and 144 (4.4%) underwent sentinel lymphadenectomy. Traditional lymphadenectomy had the highest rate of major complications (3.6%) compared with sentinel (2.0%) and no lymphadenectomy (2.0%) (p=0.03). Patients who underwent traditional lymphadenectomy also had the longest operating room times and procedures that were most surgically complex (171 min, 30.6 RVU) compared with patients who underwent sentinel lymphadenectomy (166 min, 24.9 RVU) or no lymphadenectomy (141 min, 15.0 RVU) (all p<0.001). Patients who underwent traditional lymphadenectomy had nearly twice the odds of a major complication (aOR 1.8 95%CI 1.2–2.9) and need for readmission (aOR 2.2 95% CI 1.5 – 3.4) compared to those who underwent sentinel or no lymphadenectomy. The incidence of readmission after traditional lymphadenectomy was higher (4.6%) than after sentinel lymphadenectomy (1.4%) and no lymphadenectomy (2.2%, p<0.001).

Conclusions: Sentinel lymphadenectomy among patients undergoing total laparoscopic hysterectomy for endometrial cancer was associated with a decreased incidence of major postoperative complication and need for readmission when compared with traditional lymphadenectomy.

Keywords

Clavien-Dindo; endometrial cancer; minimally invasive surgery; postoperative complication; sentinel lymph node

INTRODUCTION

Endometrial cancer is the most commonly diagnosed gynecologic malignancy in the United States[1] with a prevalence that will only increase as the US population becomes increasingly aged and obese.[2–4] Surgical evaluation is essential for staging. Over the last twenty years minimally invasive surgery (MIS) has emerged as the preferred approach.[5,6] This is in part because MIS is associated with fewer postoperative complications when compared with conventional open procedures in gynecologic oncology patients.[7–9] It is important to identify modifiable risk factors for postoperative complications given the increasing focus on quality and resource utilization in healthcare.[5,10] Obesity, age and medical co-morbidities have all been identified as risk factors for postoperative complications in patients who undergo MIS;[4,11–13] unfortunately these do not represent readily modifiable risks.

Lymph node status is the most significant predictor of survival and guides postoperative treatment decision-making in endometrial cancer patients.[1,14] The optimal method for lymph node assessment in endometrial cancer continues to be debated.[1] Sentinel lymphadenectomy is one approach that has been postulated to reduce medical and surgical complications in patients with endometrial cancer.[1] By targeting the primary lymph nodes that drain a malignancy, surgeons can better detect micrometasasis, reduce the risk of lymphedema associated with more extensive lymphadenectomy and decrease total operative time.[14] To

our knowledge, no study to date has analyzed extent of lymphadenectomy as an independent risk factor for post-operative complications in patients with endometrial cancer treated with MIS.

Although there has been focus on the long-term effects of sentinel lymphadenectomy versus traditional lymphadenectomy in reduction of lymphedema, short-term morbidity in the form of postoperative complications may also differ. It is unknown if the incidence of postoperative complication among patients with endometrial cancer undergoing sentinel lymphadenectomy more closely approximates the incidence among patients undergoing no lymphadenectomy or traditional lymphadenectomy. To examine this, we used a large surgical quality database to compare the incidence of postoperative complications among endometrial cancer patients undergoing total laparoscopic hysterectomy with traditional lymphadenectomy, sentinel lymphadenectomy, or no lymphadenectomy.

MATERIALS AND METHODS

Patients with endometrial cancer who underwent total laparoscopic hysterectomy recorded in the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database and its targeted hysterectomy file between 2015–2016 were included in this study. The ACS-NSQIP database is a national surgical quality improvement program. Participating institutions prospectively collect variables such as patient demographics, pre-operative variables, operative variables and post-operative variables for 30 days following surgery. These variables are then de-identified of both patient-specific and hospital-specific information and entered into the database. NSQIP employs third party coders, referred to as surgical clinical reviewers (SCRs), who review patient charts and continuously input data for each NSQIP site. To date, ACS NSQIP reports a 95% success rate in capturing 30-day outcomes on all cases in the program database.

International disease classification 9 and 10 (ICD-9 and ICD-10) codes were used to identify patients with endometrial cancer (ICD-9 codes 179.0, 182.0, 182.1,182.8 and ICD-10 codes C54.0-C54.3 and C54.8-C54.9). Patients with Stage I-III endometrial cancer were included while patients with stage IV endometrial cancer were excluded. Current procedural terminology (CPT) codes were used to identify patients who underwent robotic-assisted or traditional total laparoscopic hysterectomy as CPT codes themselves cannot distinguish between the two. The following primary CPT codes were included: 58570; 58571; 58572; 58573. Surgeries performed by specialists who were not Gynecologists and further by those who were not identified as Gynecologic Oncologists, subspecialists with additional training in lymph node dissection, were excluded.

The primary exposure was extent of lymphadenectomy. CPT codes were used to identify patients who underwent either sentinel or traditional lymphadenectomy. The following additional procedure CPT codes were included to identify those patients who underwent sentinel lymphadenectomy: 38792; 38790; 38900. The following additional procedure CPT codes were included to identify those patients who underwent traditional lymphadenectomy: 38572; 38571; 38562; 38564. Patients who had none of these codes recorded were categorized as not having undergone lymphadenectomy. Stratification by

extent of lymphadenectomy was defined using CPT codes and thus these results represent an intention to treat analysis.

Demographic variables abstracted included age, race and BMI. Patient-related pre-operative variables abstracted included hypertension requiring medication, diabetes mellitus requiring insulin or oral therapy, and smoking in the last year. Operative variables abstracted included operative time, year operation was performed, relative value units (RVU), and American Society of Anesthesiologists (ASA) score. Post-operative variables abstracted included time from operation to discharge, stage of disease and presence of major and minor complications. Major complications, as delineated by the Clavien-Dindo scale included: need for readmission, need to return to the OR, cardiac arrest, myocardial infarction (MI), stroke or cerebrovascular accident (CVA), renal failure, venous thromboembolism (VTE), deep venous thrombosis (DVT), pulmonary embolus (PE), sepsis, shock, intestinal obstruction, ureteral obstruction, organ space surgical site infection, ventilation necessary for >48hrs, and need for reintubation. Minor complications, as delineated by the Clavien-Dindo scale, included: blood transfusion, prolonged post op nil per os (NPO) or nasogastric tube (NGT) use, urinary tract infection (UTI), wound disruption, clostridium dificile infection (C Diff), renal insufficiency, pneumonia, superficial surgical site infection (SSI), and deep SSI. Detailed definitions of these complications can be found in the ACS-NSQIP user guide.[15,16]

The primary outcome was major postoperative complications as defined by the Clavien-Dindo scale (grade 3 or higher).[17] A composite incidence of major complication was compared between patients, stratified by degree of lymphadenectomy: traditional, sentinel and none. Categorical variables were represented by frequency and percentage, while continuous variables were represented by median and inter-quartile-range (IQR). Differences in categorical variables were determined using Chi-Squared and Fisher's exact tests. Differences in continuous variables were determined using Wilcoxon Ranksum test. Given the association of demographic and clinical factors with both complication rates and extent of lymphadenectomy, binary logistic regression was performed to address the possibility of confounding. All variables that were significantly associated with extent of lymphadenectomy on univariate analysis were examined including age, BMI, race, ASA score, year of operation, stage of disease and diabetes. A p-value of 0.05 was considered statistically significant for all analyses. Stata version 12.1 (College Station, TX) was used for all analyses. The Institutional Review Board of Northwestern University approved this study and declared it exempt from formal review.

RESULTS

A total of 3,282 patients with endometrial cancer underwent laparoscopic hysterectomy between January 2015 and December 2016. Demographic variables and known operative risk factors are presented in Table 1. No lymphadenectomy was performed in 2,049 patients (62.4%), a traditional lymphadenectomy in 1,089 patients (33.2%) and sentinel lymphadenectomy in 144 patients (4.4%). Patients who did not undergo lymphadenectomy were younger than patients undergoing lymphadenectomy. The majority of patients across all groups were white race, significantly more so among those who underwent sentinel lymphadenectomy ($p<0.001$). Overall, 8.5% of patients had smoked within

the past year and 57.1% were hypertensive. The majority of patients had an ASA score of III, indicating severe systemic disease; this was significantly more prevalent in the sentinel lymphadenectomy group (p=0.02). Similarly, the majority of patients had Stage I endometrial cancer, however, this was significantly less prevalent among patients who underwent traditional lymphadenectomy (p<0.001) compared to either no lymphadenectomy or sentinel lymphadenectomy. Patients were more likely to undergo sentinel lymphadenectomy as the operative year progressed from 2015 to 2016 (1.8% in 2015 to 6.2% in 2016, p<0.001).

To identify variables associated with extent of lymphadenectomy that may have influenced major complication rates, patients who underwent no lymphadenectomy were compared with those who underwent traditional lymphadenectomy and with those who underwent sentinel lymphadenectomy (Table 1). Patients who underwent traditional lymphadenectomy had the longest operating room times and procedures that were most surgically complex (171 min, 30.6 RVU) compared with patients who underwent sentinel lymphadenectomy (166 min, 24.9 RVU) or no lymphadenectomy (141 min, 15.0 RVU) (all p<0.001). The percentage of patients discharged after >1 day was 9.7% among those who underwent sentinel lymphadenectomy, compared with 14.1% in both those who underwent traditional lymphadenectomy and those who did not undergo lymphadenectomy (p=0.002).

Total laparoscopic hysterectomy with traditional lymphadenectomy had the highest rate of major complications (3.6%) compared with sentinel lymphadenectomy (2.0%) and with patients who did not undergo lymphadenectomy (2.0%) (p=0.03) (Table 2). Patients who underwent traditional lymphadenectomy also had the highest rate of DVT (0.6%) compared with sentinel lymphadenectomy (0.0%) and with patients who did not undergo lymphadenectomy (0.1%) (p=0.04). By contrast, patients who underwent sentinel lymphadenectomy had the highest rate of PE (2.1%) compared with traditional lymphadenectomy (0.7%) and with patients who did not undergo lymphadenectomy (0.2%) (p=0.003). Patients who underwent sentinel lymphadenectomy also had the highest rate of VTE (2.1%), the entire contribution coming from three patients with PE, compared with traditional lymphadenectomy (1.1%) and with patients who did not undergo lymphadenectomy (0.3%) (p=0.005), with some patients sustaining both DVT and PE in these groups. The incidence of readmission after traditional lymphadenectomy was higher (4.6%) than after sentinel lymphadenectomy (1.4%) and no lymphadenectomy (2.2%, p<0.001). No significant differences were observed in the incidence of any other minor or major complications. Patients who underwent traditional lymphadenectomy had a composite total complication rate (7.2%) comparable with that observed in patients who underwent sentinel lymphadenectomy (4.8%) and those who did not undergo lymphadenectomy (6.5%) (p=0.53). None of the patients who underwent sentinel lymphadenectomy were brought back to the operating room for additional procedures, however, six patients who underwent traditional lymphadenectomy and twelve patients who did not undergo lymphadenectomy returned to the operating room for additional procedures (p=0.66).

Patients who underwent traditional lymphadenectomy had nearly twice the odds of a major complication (OR 1.8 95% CI 1.1–2.8) compared to those who did not undergo lymphadenectomy (Table 3). The odds of a major complication in patients

who underwent sentinel lymphadenectomy were comparable to the odds in those who did not undergo lymphadenectomy (OR 1.0 95% CI 0.3–3.3). With adjustment these relationships remained intact; traditional lymphadenectomy had nearly twice the odds of a major complication compared to no lymphadenectomy (aOR 1.8 95% CI 1.2–2.9), while sentinel lymphadenectomy complication rates were comparable to no lymphadenectomy (aOR 1.1 95% CI 0.3–3.5). The odds of readmission in those who underwent traditional lymphadenectomy were twice that observed in those who did not undergo lymphadenectomy, with (aOR 2.2 95% CI 1.5 – 3.4) and without adjustment (OR 2.1 95% CI 1.4 – 3.2). The odds of readmission in those who underwent sentinel lymphadenectomy were equivalent to that observed in those who did not undergo lymphadenectomy, with (aOR 0.7 95% CI 0.2 – 2.9) and without adjustment (OR 0.6 95% CI 0.2 – 2.6). The odds of returning to the operating room in those who underwent traditional lymphadenectomy were equivalent to that observed in those who did not undergo lymphadenectomy, with (aOR 1.0 95% CI 0.4 – 2.7) and without adjustment (OR 0.9 95% CI 0.4 – 2.5). Patients who underwent traditional lymphadenectomy had equivalent odds of having any major or minor complication (OR 1.1 95% CI 0.8–1.5) compared to those who did not undergo lymphadenectomy and those who underwent sentinel lymphadenectomy (OR 0.7 95% CI 0.3–1.6). These relationships were not affected by adjustment (aOR 1.1 95% CI 0.8–1.5; aOR 0.8 95% CI 0.4–1.7).

DISCUSSION

Sentinel lymphadenectomy has been shown to have acceptable sensitivity in detecting metastatic disease in the staging of endometrial cancer.[14] In women with low-grade, low risk endometrial cancer, systematic pelvic and para-aortic lymphadenectomy does not improve oncologic outcomes or survival.[18–20] Complete lymphadenectomy in such patients increases potential morbidity and health-care associated costs; 23% develop symptomatic lymphedema,[21] and many experience worse quality of life, as well as poor sexual and emotional health.[21–30] A reduction in lymphedema is the often focused-on potential benefit of sentinel lymphadenectomy, however, our study also found an association between lower complication and readmission rates among patients undergoing sentinel as compared with traditional lymphadenectomy.

The association between increasing operative time and post-operative complications is well established in studies of minimally invasive surgery for benign gynecologic disease. Longer operative time has been shown to be independently associated with increased overall complication rate, reoperation rate, and rate of thrombotic events, urinary tract infections and need for blood transfusion.[13] In a retrospective study of data collected from the ACS-NSQIP database between 2005 and 2014 an overall complication rate of 7%[5] was noted in patients undergoing MIS for endometrial cancer, consistent with the overall complication rates observed in each arm of our study (6.5%, 7.2% and 4.9%). This complication rate is significantly lower than that observed in GOG LAP2[8], which reported a complication rate of 14%. The median operative time for laparoscopy in GOG LAP2 was 204 min, compared with 173 min in the 2005–2014 ACS-NSQIP study, both of which compare favorably with our study results (141 mins; 171 mins; 166 mins). Though the results of our study demonstrate a reduction in operative time between the traditional and sentinel

lymphadenectomy arms, it is important to note that this is a difference of five minutes which may not be clinically meaningful for patients or providers. As more providers become familiar with sentinel lymphadenectomy and adoption increases, this difference in operative time may become more pronounced.

In this study, we found that sentinel lymphadenectomy is associated with lower major postoperative complication and readmission rates, and higher rates of same day discharge even after adjustment for potential confounders. Interestingly, patients undergoing sentinel lymphadenectomy had higher BMIs, higher rates of diabetes and hypertension, and higher ASA scores than patients undergoing traditional lymphadenectomy. Even in the face of a higher prevalence of risk factors for complication, complication rates were lower for the sentinel lymphadenectomy group. For patients with endometrial cancer, who often have many medical comorbidities, our study suggests that similar to minimally invasive surgery, which mitigates the effects of comorbidities on complication compared to open surgery for this population, sentinel lymphadenectomy may have a similar effect.

The exception to this is the rate of PE, which was significantly increased in patients who underwent sentinel lymphadenectomy (2.1%). This may be related to the significantly shorter inpatient stays and prevalence of same day discharges in this group which may result in lower rates of pharmacologic prophylaxis. The relationship between VTE and sentinel lymphadenectomy is an interesting finding. In urologic surgery it has been suggested that dissection along vascular structures to achieve lymphadenectomy is associated with increased VTE risk, beyond the primary prothrombotic effect of cancer.[31] However, we would expect VTE to be proportionally increased in the traditional lymphadenectomy arm of our study, as incidence of VTE is associated with the venous stasis and inflammatory milieu that results from prolonged immobilization and increased operative time.

Similar to other studies of the adoption of sentinel lymphadenectomy, we found overall low rates of use of this technique with only 4.4% of patients undergoing this approach. This is consistent with results from the National Cancer Database which found that only 2.8% of patients underwent sentinel lymphadenectomy in 2013 and 4.3% underwent sentinel lymphadenectomy in 2014.[32] We also found an increase in use over the two years of our study period with only 1.8% of patients receiving sentinel lymphadenectomy in 2015 compared with 6.2% in 2016. With the publication of the FIRES trial and a comprehensive systematic review of the technique in 2017, we would expect these rates to continue to increase over time.

Our study makes use of information collected in the ACS-NSQIP database and its targeted hysterectomy file between 2015–2016. This database was created by the American College of Surgeons to report on quality metrics; the data has been rigorously collected and independently validated. In contrast to prior studies, we are able to describe the stage of endometrial cancer between patient groups, which influences operative time and indication for extent of lymphadenectomy. The ability to adjust for this important variable helps to limit confounding by indication. Further, this national dataset avoids the weaknesses of single-institution and single-surgeon studies, which may lack generalizability.

Conversely, although a large number of institutions participate in NSQIP, participation is voluntary and academic and large institutions are over-represented, therefore results may not be generalizable. Additionally, selection of patients was based on CPT, ICD-9 and ICD-10 codes and we cannot exclude the possibility of miscoding or misclassification. We are also limited by our inability to describe the method of MIS – given shared CPT codes for conventional and robotic assisted laparoscopic hysterectomy – and the fact that the extent of the lymphadenectomy in terms of total lymph nodes removed is unknown in this data source. We are further limited in that we have no way to ascertain whether the mapping of sentinel lymph nodes was successful or not. In addition, this time period represents the early adoption of sentinel lymphadenectomy and thus successful mapping rates may have been lower; however, even with this likely high rate of completion lymphadenectomy a difference in complication was found, suggesting the difference may actually larger than estimated. In contrast to large databases that utilize billing and coding data only, NSQIP data is prospectively collected by trained personnel with the express purpose of improving surgical quality and reducing peri-operative complications. Thus, it is less likely to fail to record an adverse event in the post-operative period. Periodic audits are also performed on the data and reveal only a 1.8% disagreement rate confirming the accuracy of the data[15]. NSQIP only records 30-day post-operative data and thus our post-operative complication rates do not include events that occurred after that time point and may underestimate true rates. Additionally, intra-operative complications are not recorded in NSQIP and thus this data is not available as part of this analysis.

We found that in a large surgical quality improvement database, among patients with endometrial cancer undergoing total laparoscopic hysterectomy, sentinel lymphadenectomy was independently associated with a decreased incidence of major post-operative complications and need for readmission when compared with traditional lymphadenectomy, and had similar risk to that observed in cases where no lymphadenectomy was performed. Our data may help gynecologic oncologists assess the need for traditional lymphadenectomy in patients for whom sentinel lymphadenectomy is a reasonable alternative, and provides an accurate estimation of contemporary major postoperative complication and readmission rates among endometrial cancer patients who undergo MIS in the United States.

Acknowledgements:

Dr. Barber is supported by NIH K12 HD050121-12.

REFERENCES

1. Bodurtha Smith AJ, Fader AN, Tanner EJ. Sentinel lymph node assessment in endometrial cancer: a systematic review and meta-analysis. Am J Obstet Gynecol. 2017;216(5):459–476 e410. [PubMed: 27871836]
2. Adedayo P, Resnick K, Singh S. Preoperative frailty is a risk factor for non-home discharge in patients undergoing surgery for endometrial cancer. J Geriatr Oncol. 2018.
3. Mahdi H, Lockhart D, Maurer KA. Impact of age on 30-day mortality and morbidity in patients undergoing surgery for endometrial cancer. Gynecol Oncol. 2015;137(1):106–111. [PubMed: 25640765]

4. Gunderson CC, Java J, Moore KN, Walker JL. The impact of obesity on surgical staging, complications, and survival with uterine cancer: a Gynecologic Oncology Group LAP2 ancillary data study. Gynecol Oncol. 2014;133(1):23–27. [PubMed: 24680587]
5. Singh S, Swarer K, Resnick K. Longer operative time is associated with increased post-operative complications in patients undergoing minimally-invasive surgery for endometrial cancer. Gynecol Oncol. 2017;147(3):554–557. [PubMed: 28982521]
6. Moukarzel LA, Sinno AK, Fader AN, Tanner EJ. Comparing Single-Site and Multiport Robotic Hysterectomy with Sentinel Lymph Node Mapping for Endometrial Cancer: Surgical Outcomes and Cost Analysis. J Minim Invasive Gynecol. 2017;24(6):977–983. [PubMed: 28599884]
7. Mahdi H, Aljebori Q, Lockart D, Moulton L. Risk of Venous Thromboembolism After Laparoscopic Surgery for Gynecologic Malignancy. J Minim Invasive Gynecol. 2016;23(7):1057–1062. [PubMed: 27353413]
8. Walker JL, Piedmonte MR, Spirtos NM, et al. Laparoscopy compared with laparotomy for comprehensive surgical staging of uterine cancer: Gynecologic Oncology Group Study LAP2. J Clin Oncol. 2009;27(32):5331–5336. [PubMed: 19805679]
9. Palomba S, Falbo A, Mocciaro R, Russo T, Zullo F. Laparoscopic treatment for endometrial cancer: a meta-analysis of randomized controlled trials (RCTs). Gynecol Oncol. 2009;112(2):415–421. [PubMed: 18973934]
10. Barber EL, Harris B, Gehrig PA. Trainee Participation in Benign Hysterectomy: Effects of Surgical Approach and Operative Time. J Minim Invasive Gynecol. 2015;22(6S):S76.
11. Wright JD, Burke WM, Tergas AI, et al. Comparative Effectiveness of Minimally Invasive Hysterectomy for Endometrial Cancer. J Clin Oncol. 2016;34(10):1087–1096. [PubMed: 26834057]
12. Kornblith AB, Huang HQ, Walker JL, Spirtos NM, Rotmensch J, Cella D. Quality of life of patients with endometrial cancer undergoing laparoscopic international federation of gynecology and obstetrics staging compared with laparotomy: a Gynecologic Oncology Group study. J Clin Oncol. 2009;27(32):5337–5342. [PubMed: 19805678]
13. Catanzarite T, Saha S, Pilecki MA, Kim JY, Milad MP. Longer Operative Time During Benign Laparoscopic and Robotic Hysterectomy Is Associated With Increased 30-Day Perioperative Complications. J Minim Invasive Gynecol. 2015;22(6):1049–1058. [PubMed: 26070725]
14. Rossi EC, Kowalski LD, Scalici J, et al. A comparison of sentinel lymph node biopsy to lymphadenectomy for endometrial cancer staging (FIRES trial): a multicentre, prospective, cohort study. The Lancet Oncology. 2017;18(3):384–392. [PubMed: 28159465]
15. American College of Surgeons. User Guide for the 2015 ACS NSQIP Participant Use Data File (PUF). October 2016. https://www.facs.org/~/media/files/quality%20programs/nsqip/nsqip_puf_user_guide_2015.ashx. Accessed on June 1st, 2018.
16. American College of Surgeons. User Guide for the 2015 ACS NSQIP Procedure Targeted Participant Use Data File (PUF). October 2016. https://www.facs.org/~/media/files/quality%20programs/nsqip/pt_nsqip_puf_user_guide_2015.ashx. Accessed on June 1st, 2018.
17. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. Ann Surg. 2004;240(2):205–213. [PubMed: 15273542]
18. Sinno AK, Peijnenburg E, Fader AN, et al. Reducing overtreatment: A comparison of lymph node assessment strategies for endometrial cancer. Gynecol Oncol. 2016;143(2):281–286. [PubMed: 27568279]
19. group As, Kitchener H, Swart AM, Qian Q, Amos C, Parmar MK. Efficacy of systematic pelvic lymphadenectomy in endometrial cancer (MRC ASTEC trial): a randomised study. Lancet. 2009;373(9658):125–136. [PubMed: 19070889]
20. Benedetti Panici P, Basile S, Maneschi F, et al. Systematic pelvic lymphadenectomy vs. no lymphadenectomy in early-stage endometrial carcinoma: randomized clinical trial. J Natl Cancer Inst. 2008;100(23):1707–1716. [PubMed: 19033573]
21. Yost KJ, Cheville AL, Al-Hilli MM, et al. Lymphedema after surgery for endometrial cancer: prevalence, risk factors, and quality of life. Obstet Gynecol. 2014;124(2 Pt 1):307–315. [PubMed: 25004343]

22. Kim SI, Lim MC, Lee JS, et al. Impact of lower limb lymphedema on quality of life in gynecologic cancer survivors after pelvic lymph node dissection. Eur J Obstet Gynecol Reprod Biol. 2015;192:31–36. [PubMed: 26142914]

23. Symvoulakis EK, Anyfantakis DI, Lionis C. Primary lower limb lymphedema: a focus on its functional, social and emotional impact. Int J Med Sci. 2010;7(6):353–357. [PubMed: 20975845]

24. Bats AS, Nos C, Bensaid C, et al. Lower-limb drainage mapping for lymphedema risk reduction after pelvic lymphadenectomy for endometrial cancer. Oncologist. 2013;18(2):174–179. [PubMed: 23335621]

25. Beesley VL, Rowlands IJ, Hayes SC, et al. Incidence, risk factors and estimates of a woman's risk of developing secondary lower limb lymphedema and lymphedema-specific supportive care needs in women treated for endometrial cancer. Gynecol Oncol. 2015;136(1):87–93. [PubMed: 25448454]

26. Rowlands IJ, Beesley VL, Janda M, et al. Quality of life of women with lower limb swelling or lymphedema 3–5 years following endometrial cancer. Gynecol Oncol. 2014;133(2):314–318. [PubMed: 24631452]

27. Mitra D, Catalano PJ, Cimbak N, Damato AL, Muto MG, Viswanathan AN. The risk of lymphedema after postoperative radiation therapy in endometrial cancer. J Gynecol Oncol. 2016;27(1):e4. [PubMed: 26463430]

28. Ghezzi F, Uccella S, Cromi A, et al. Lymphoceles, lymphorrhea, and lymphedema after laparoscopic and open endometrial cancer staging. Ann Surg Oncol. 2012;19(1):259–267. [PubMed: 21695563]

29. Salani R, Preston MM, Hade EM, et al. Swelling among women who need education about leg lymphedema: a descriptive study of lymphedema in women undergoing surgery for endometrial cancer. Int J Gynecol Cancer. 2014;24(8):1507–1512. [PubMed: 25078342]

30. Todo Y, Yamamoto R, Minobe S, et al. Risk factors for postoperative lower-extremity lymphedema in endometrial cancer survivors who had treatment including lymphadenectomy. Gynecol Oncol. 2010;119(1):60–64. [PubMed: 20638109]

31. Rice KR, Brassell SA, McLeod DG. Venous thromboembolism in urologic surgery: prophylaxis, diagnosis, and treatment. Rev Urol. 2010;12(2–3):e111–124. [PubMed: 20811548]

32. Gomez-Hidalgo NR, Chen L, Hou JY, et al. Trends in Sentinel Lymph Node Mapping and Adjuvant Therapy in Endometrial Carcinoma. Cancer Invest. 2018;36(3):190–198. [PubMed: 29565689]

AJOG At A Glance:

- Controversy exists regarding the optimal extent of lymphadenectomy in management of clinically early stage endometrial cancer.
- Sentinel lymphadenectomy is associated with lower rates of major complication and need for readmission compared with traditional lymphadenectomy.
- Patients who undergo sentinel lymphadenectomy have similar rates of major complication and need for readmission as those who do not undergo lymphadenectomy.

Table 1:

Characteristics of patients who underwent total laparoscopic hysterectomy for endometrial cancer

	No lymphadenectomy (N=2,049)	Lymphadenectomy (N=1,089)	Sentinel lymphadenectomy (N=144)	p
Age	61.7±0.25	64.4±0.31	63.0±0.90	<0.001
BMI	35.8 (29.5–43.4)	32.7 (27.4–39.0)	36.5 (30.3–40.8)	<0.001
American Indian or Alaska Native	8 (0.4)	5 (0.5)	0 (0.0)	<0.001
Asian or Pacific Islander	72 (3.5)	46 (4.2)	3 (2.1)	
	83 (4.1)	58 (5.3)	8 (5.6)	
Black	1,716 (83.7)	831 (76.3)	132 (91.7)	
White	170 (8.3)	149 (13.7)	1 (0.7)	
Unknown Race				
Hypertension	1,174 (57.3)	618 (56.7)	86 (59.7)	0.79
Diabetes Mellitus	506 (24.7)	213 (19.6)	34 (23.6)	0.005
Current smoking	167 (8.2)	101 (9.3)	12 (8.3)	0.56
ASA score				0.02
I No disturbance	29 (1.4)	15 (1.4)	0 (0.0)	
II Mild disturbance	862 (42.1)	498 (45.7)	64 (44.4)	
III Severe disturbance	1,083 (52.9)	553 (50.8)	80 (55.6)	
IV Life threatening	75 (3.7)	23 (2.1)	0 (0.0)	
Stage of disease				<0.001
I	1,750 (85.4)	798 (73.3)	123 (85.4)	
II	152 (7.4)	142 (13.0)	11 (7.6)	
III	147 (7.2)	149 (13.7)	10 (7.0)	
Year of operation				<0.001
2015	867 (42.3)	460 (42.2)	24 (16.7)	
2016	1,182 (57.7)	629 (57.8)	120 (83.3)	
Total OP time (min)	141 (110–183)	171 (133–211)	166 (138–209)	<0.001
Total RVU	15.0 (15.0–21.2)	30.6 (29.2–32.0)	24.9 (24.0–26.2)	<0.001
Surgical efficiency (RVU/min)	0.12 (0.10–0.17)	0.19 (0.15–0.25)	0.15 (0.12–0.18)	<0.001
Length of stay				0.002
Same day discharge	171 (8.3)	130 (11.9)	8 (5.6)	
Discharge after 1 day	1,590 (77.6)	805 (73.9)	122 (84.7)	
Discharge after >1 day	288 (14.1)	154 (14.1)	14 (9.7)	

All data is presented as n (%) for categorical variables, mean ± standard error for normally distributed variables, and median with inter-quartile range for non-normally distributed continuous variables. BMI – body mass index; ASA – American Society of Anesthesiologists; OP – operative; RVU – relative value unit

Table 2:

Postoperative complication rates, stratified by degree of lymphadenectomy in patients who underwent total laparoscopic hysterectomy for endometrial cancer

	No lymphadenectomy (N=2,049)	Lymphadenectomy (N=1,089)	Sentinel lymphadenectomy (N=144)	p
Major complication composite	42 (2.0)	39 (3.6)	3 (2.1)	**0.03**
Cardiac arrest	2 (0.1)	0 (0.0)	0 (0.0)	0.56
Myocardial infarction	4 (0.2)	1 (0.1)	0 (0.0)	0.69
Stroke/CVA	4 (0.2)	1 (0.1)	0 (0.0)	0.69
Renal Failure	2 (0.1)	1 (0.1)	0 (0.0)	0.93
VTE	7 (0.3)	12 (1.1)	3 (2.1)	**0.005**
DVT	2 (0.1)	6 (0.6)	0 (0.0)	**0.04**
PE	5 (0.2)	8 (0.7)	3 (2.1)	**0.003**
Shock	4 (0.2)	3 (0.3)	0 (0.0)	0.76
Sepsis	10 (0.5)	6 (0.6)	0 (0.0)	0.67
Intestinal obstruction	6 (0.3)	8 (0.7)	0 (0.0)	0.14
Ureteral obstruction	0 (0.0)	1 (0.1)	0 (0.0)	0.37
Deep organ SSI	21(1.0)	20 (1.8)	1 (0.7)	0.13
Re-intubation	8 (0.4)	3 (0.3)	0 (0.0)	0.67
>48hr Ventilated	5 (0.2)	3 (0.3)	0 (0.0)	0.82
Any complication composite	134 (6.5)	78 (7.2)	7 (4.9)	0.53
Blood transfusion	23 (1.1)	16 (1.5)	0 (0.0)	0.28
Prolonged post operative NPO or NGT use	12 (0.6)	8 (0.7)	0 (0.0)	0.55
UTI	49 (2.4)	18 (1.7)	1 (0.7)	0.19
Wound Disruption	3 (0.1)	1 (0.1)	0 (0.0)	0.84
C Diff	1 (0.0)	1 (0.1)	0 (0.0)	0.90
Renal insufficiency	4 (0.2)	4 (0.4)	0 (0.0)	0.54
Pneumonia	5 (0.2)	2 (0.2)	1 (0.7)	0.51
Superficial SSI	17 (0.8)	6 (0.6)	2 (1.4)	0.47
Deep SSI	4 (0.2)	1 (0.1)	0 (0.0)	0.69
Readmission	46 (2.2)	50 (4.6)	2 (1.4)	**<0.001**
Return to OR	12 (0.6)	6 (0.6)	0 (0.0)	0.66

All data is presented as n (%) for categorical variables. Because complications are not mutually exclusive n (%) columns may not add up to the composite rate. CVA – cerebrovascular accident; VTE – venous thromboembolism DVT – deep venous thrombosis; PE – pulmonary embolus; SSI – surgical site infection; NPO – nil per os; NGT – nasogastric tube; UTI – urinary tract infection; C Diff – clostridium difficile; OR – operating room

Table 3:

Association between degree of lymphadenectomy and major postoperative complications

	OR	95% CI	aOR	95% CI
Odds of major complication				
No lymphadenectomy	Ref	--	--	--
Lymphadenectomy	1.77	1.14–2.76	1.84	1.17–2.91
Sentinel lymphadenectomy	1.04	0.31–3.32	1.05	0.32–3.46
Odds of any complication				
No lymphadenectomy	Ref	--	--	--
Lymphadenectomy	1.10	0.83–1.47	1.13	0.84–1.53
Sentinel lymphadenectomy	0.73	0.33–1.59	0.79	0.36–1.74
Odds of returning to the OR				
No lymphadenectomy	Ref	--	--	--
Lymphadenectomy	0.94	0.35–2.51	0.99	0.36–2.73
Sentinel lymphadenectomy	--	--	--	--
Odds of readmission				
No lymphadenectomy	Ref	--	--	--
Lymphadenectomy	2.10	1.39–3.15	2.20	1.45–3.35
Sentinel lymphadenectomy	0.61	0.15–2.55	0.69	0.16–2.89
Odds of major complication				
Sentinel lymphadenectomy	Ref	--	--	--
Lymphadenectomy	1.75	0.53–5.72	1.60	0.48–5.45
Odds of any complication				
Sentinel lymphadenectomy	Ref	--	--	--
Lymphadenectomy	1.51	0.68–3.34	1.42	0.62–3.22
Odds of readmission				
Sentinel lymphadenectomy	Ref	--	--	--
Lymphadenectomy	3.42	0.82–14.19	3.14	0.74–13.35

Adjusted odds ratios are adjusted for age, BMI, race, ASA score, year of operation, stage of disease and presence of diabetes. OR – odds ratio; aOR – adjusted odds ratio; CI – confidence interval