Laparoscopic Hysterectomy for Oncologic Patients

7

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It has been well established that minimally invasive surgery (MIS) offers many benefits compared to laparotomy including decreased blood loss and risk of transfusion, a faster less painful recovery, and a shorter (or no) hospital stay. The application of MIS to the field of gynecologic oncology continues to evolve in response to new research and its effect on cancer specific outcomes. Laparoscopy has long been accepted for the staging, and management of early-stage endometrial cancer and MIS is now largely considered standard of care after the emergence of prospective randomized data to support equivalent oncologic outcomes. Conversely, practice has recently trended away from minimally invasive radical hysterectomy for the management of early-stage cervical cancer based on randomized prospective data demonstrating worse outcomes when compared to laparotomy. Current guidelines also recommend laparotomy for primary treatment of advanced ovarian, fallopian tube, and primary peritoneal malignancy. Recent findings suggest there may be a role for minimally invasive techniques for early-stage ovarian cancer and interval debulking after neoadjuvant chemotherapy in select patients. This chapter highlights the most updated research and clinical guidelines regarding the application of MIS for gynecologic malignancies and describes techniques for laparoscopic hysterectomy and related procedures specific to oncologic patients.

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Uterine Cancer

Indications for Laparoscopic Surgery for Uterine Cancer

Primary management of apparent early-stage endometrial cancer confined to the uterus includes a total hysterectomy, bilateral salpingo-oophorectomy and lymph node assessment including pelvic and para-aortic lymphadenectomy. Based on robust data including prospective clinical trials and systematic reviews, a minimally invasive approach is now the standard of care [1]. In the randomized phase III LAP2 trial comparing laparoscopy to laparotomy for hysterectomy, salpingo-oophorectomy, pelvic cytology, and pelvic and para-aortic lymphadenectomy in patients with clinical stage I to IIA uterine cancer, short-term perioperative results showed that laparoscopic surgical staging is feasible and associated with fewer postoperative complications, a shorter hospital stay, and no statistically significant difference in intraoperative

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complications [2]. There was, however, a 25.8% conversion rate from laparoscopy to laparotomy, with over half of those cases noted to be due to poor exposure and approximately 16% due to extensive disease requiring laparotomy for resection [2]. Interval assessments of the LAP2 trial revealed comparable recurrence and survival rates among the two arms [3], as well as a statistically significant although clinically modest improvement in quality of life 6 weeks after laparoscopy compared to laparotomy, although this did not persist at 6 months post-surgery [4]. Similarly, the Laparoscopic Approach to Cancer of the Endometrium (LACE) trial, which compared total abdominal hysterectomy (TAH) to total laparoscopic hysterectomy (TLH) in patients with stage I endometrial carcinoma, reported improved perioperative outcomes with MIS and no significant difference in recurrence and overall survival rates [5, 6]. A MIS approach is also preferable for the more aggressive uterine tumor types including serous carcinoma, clear cell carcinoma, and carcinosarcomas, whenever technically feasible.

Laparoscopic Versus Robotic Minimally Invasive Surgery in Endometrial Cancer

While the National Comprehensive Cancer Network (NCCN) guidelines recommend a minimally invasive approach for primary management of early-stage endometrial cancer, to date there are no guidelines regarding the decision to pursue this laparoscopically versus robotically. A randomized controlled trial comparing traditional versus robotic-assisted laparoscopic hysterectomy, bilateral salpingo-oophorectomy, and lymphadenectomy among 99 patients with low-grade endometrial carcinoma reported significantly shorter operative times and a lower rate of conversion to laparotomy in the robotic group, while all other surgical outcomes including blood loss, postoperative pain scores, intraoperative, and postoperative complication rates showed no significant difference [7]. Several large retrospective studies and systematic reviews have also compared minimally invasive approaches. One systematic review comparing traditional and robotic-assisted laparoscopic approaches in 10,800 obese patients with endometrial cancer reported similar rates of perioperative complications and conversion to laparotomy. However, the authors suggested a robotic technique may be more feasible in patients with a body mass index (BMI) greater than or equal to 40 kg/m^2 who are more likely to be unable to tolerate steep Trendelenburg and higher intraperitoneal pressures required for laparoscopic surgery [8]. Retrospective studies have similarly shown comparable morbidity and oncologic outcomes associated with robotic versus laparoscopic approaches in endometrial cancer [9, 10]. Presently, the specific route of MIS remains dependent upon surgeon preference and ability, patient selection, and available equipment.

Total Laparoscopic Hysterectomy Technique for Endometrial Cancer

Preparation

Prior to definitive surgical staging, imaging should be obtained to evaluate the extent of disease and possible metastases. This may include a CT chest, abdomen and pelvis, a pelvic MRI to assess for local disease extent, and/or a PET/CT for suspected metastatic disease. Once classified as suitable for primary surgery, the patient should undergo preoperative assessment to optimize for the surgical staging procedure. This includes evaluating medical comorbidities and categorizing potential surgical risk using a scale, such as the American Society of Anesthesiologists (ASA) physical status score, to determine if further labs and testing should be ordered to optimize the patient for surgery. Immediately prior to surgery, a single dose of antibiotic prophylaxis with 2 grams of intravenous cefazolin is recommended (3 grams for patients weighing >120 kilograms). Additionally, 5000 units of subcutaneous heparin is administered 2 hours preoperatively for venous thromboembolism prophylaxis. Once in the operating room, the patient must be properly positioned. A pink pad is placed on the operating

table to eliminate patient sliding while in a steep Trendelenburg position. The patient is then placed into dorsal lithotomy position with legs placed into Yellofin or similar stirrups, and both arms are tucked on either side. After sterile preparation, a Foley catheter and uterine manipulator such as the VCare is placed to enhance visualization, aid with countertraction, and demarcate borders for the vaginal colpotomy.

Procedure

Entry into the abdomen is most frequently gained at the umbilicus. We prefer accessing Palmer's point in the left upper quadrant for primary entry, which can be beneficial in patients with a bulky uterus or prior abdominal surgeries. When entering at Palmer's point, the stomach must first be decompressed with an orogastric or nasogastric tube to prevent injury. Primary access can be obtained using the Veress needle or the open Hasson technique or via direct visualization with an optical trocar. After initial port placement, the abdomen is insufflated, a survey of the entire abdomen is performed, and the patient is placed into the Trendelenburg position to displace bowel and optimize pelvic visualization. Additional ports are placed under direct visualization, with careful attention paid to location. Accessory trocars are traditionally placed at the umbilicus and bilateral lower quadrants, approximately 2 centimeters superior and medial to the anterior superior iliac spine (Fig. 7.1). We prefer to place accessory ports slightly higher on the abdomen forming the shape of a shallow arc instead of a diamond, which allows for easier access to larger uteri or pelvic masses and a better vantage point for lymphadenectomy.

The hysterectomy begins with incising either the round ligament or the peritoneum just lateral to the ovarian vessels, thereby opening and separating the anterior and posterior leaves of the broad ligament and developing the retroperitoneal space. The ureter is then identified retroperitoneally on the medial leaf of the broad ligament coursing inferior to the ovarian vessels, and the pararectal space is developed. The infundibulopelvic (IP) ligament is isolated, and the ovarian vessels can then be safely cauterized and divided. The medial leaf of the broad ligament is divided past the utero-ovarian ligament to the uterosacral ligament paying careful attention to the uterine artery and vein. By opening the peritoneum, the anatomic landmarks are more clearly visualized for precise dissection. Next, the anterior leaf of

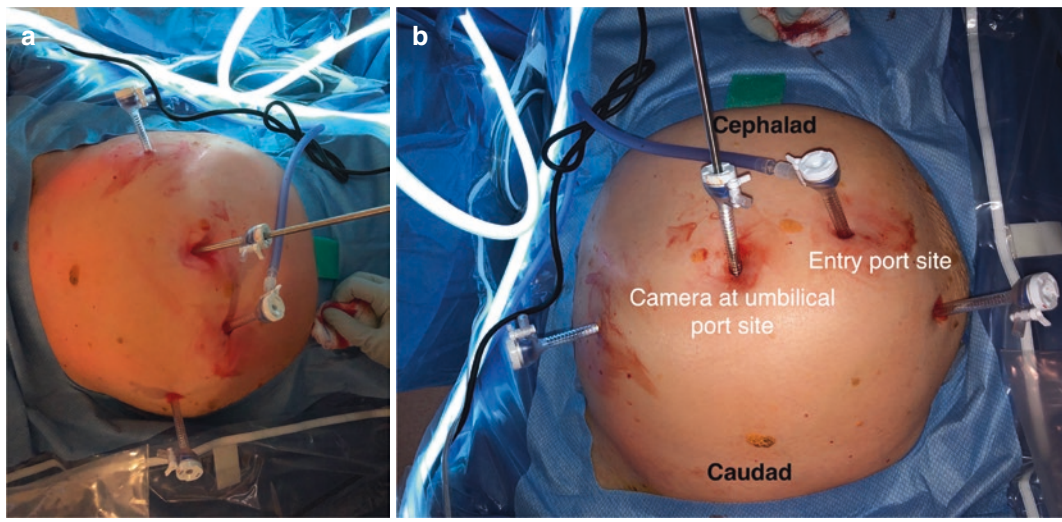

Fig. 7.1 (**a**, **b**) An external view of the laparoscopic port placement technique to ensure access to the pelvis, pelvic sidewall, and upper abdomen if necessary. The camera is placed at the umbilical port after peritoneal access is gained through a modified Palmer's point entry site. This configuration can be used with four ports (as demonstrated) or three omitting the right lateral port site if extra retraction is not necessary

the broad ligament is bluntly dissected toward the level of the cervix, where the bladder flap is carefully created in order to push the bladder away from the cervix in preparation for the colpotomy. When dissecting the overlying peritoneum away from the underlying structures, it is important to first develop potential space with the blunt dissection of a laparoscopic instrument to allow adequate visualization of the uterine vessels and the bladder edge. Once the peritoneum has been transected safely, these important structures will be even better visualized and undamaged. The bladder can often be pushed away from the cervix with careful blunt dissection, however with adhesions formed by prior surgery or inflammation release of denser tissue often referred to as bladder pedicles which may require cautery to transect. The location of the bladder edge must be carefully visualized especially in the presence of adhesions. Techniques to insure the location of the bladder include using the Foley bulb, backfilling the bladder with a dyed liquid or sterile milk and cystoscopy.

The uterine arteries are further skeletonized bilaterally and then cauterized and divided using bipolar energy. By cauterizing and incising the tissue between the uterine artery and the cervix, the uterine artery pedicle is moved away from the path of the colpotomy. We accomplish this by introducing the bipolar instrument from the opposite side of the pelvis in order for it to lie directly parallel to the uterine artery and flush to the cervix. Transection of the cardinal ligaments serves to lateralize the pedicles away from the colpotomy cup. The colpotomy is then performed using a monopolar hook or paddle to circumferentially release the specimen from the vagina with guidance from the intrauterine manipulator to delineate the cervicovaginal junction. We use an extended bovie tip for laparoscopy instead of the traditional monopolar with foot pedal control. This allows for both cut and cautery functions to be used with easy hand control. The specimen should be removed en bloc, avoiding morcellation or fragmentation for optimal oncologic outcomes. Closure of the colpotomy can be performed either laparoscopically or vaginally with absorbable suture in a running fashion or using serial figure-of-eight stitches. Our practice is to close the vaginal cuff laparoscopically with barbed suture in a running fashion, thereby minimizing knot tying and closure time while maximizing suture tensile strength.

Lymphadenectomy Technique for Endometrial Cancer

Sentinel Lymph Node Technique

Complete surgical staging is the most important prognostic factor for endometrial cancer and traditionally included a complete pelvic and para-aortic lymph node dissection. However, based on conclusions from multiple prospective and retrospective studies, sentinel lymph node (SLN) mapping may now be safely considered in patients with suspected uterine-confined disease. The FIRES trial, a prospective cohort study of SLN mapping followed by pelvic lymphadenectomy with or without para-aortic lymphadenectomy, concluded that SLN identification is highly sensitive for detecting endometrial cancer metastases and can safely substitute for systematic lymphadenectomy. Although 3% of patients with node-positive disease are missed by this technique, the study authors concluded that this risk is outweighed by the significant benefits and decreased morbidity gained by avoiding complete lymphadenectomy [11]. A Cochrane review including a total of 2237 women reported a mean SLN detection rate of 86.9% and a sensitivity of 91.8% among detected nodes [12]. To perform SLN identification, tracer dye is injected 1 centimeter deep into the cervix at the 3 o'clock and 9 o'clock positions and travels along the uterine lymphatic trunks to identify the first nodes in the chain to drain from the uterus which are the most likely to contain metastatic disease. While a variety of different types of dyes can be used, we prefer indocyanine green (ICG) due to its easily identified, real-time fluorescence especially in morbidly obese patients (Fig. 7.2). Once identified and resected, ultra-staging of the node is performed, which entails serial sectioning and performing hematoxylin and eosin staining to improve sensitivity for detecting tumor cells (Fig. 7.3).

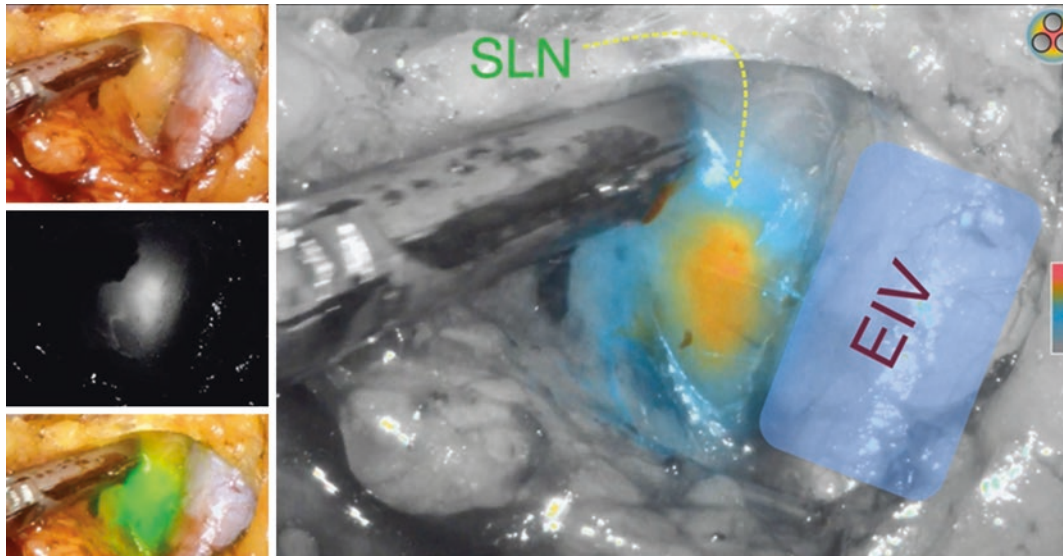

Fig. 7.2 The sentinel lymph node is identified via fluorescence technology highlighted with a green color. In this figure an obturator node has been identified by entering the retroperitoneal pelvic sidewall on the right side. The sentinel lymph node sits directly adjacent to the external iliac vein (EIV)

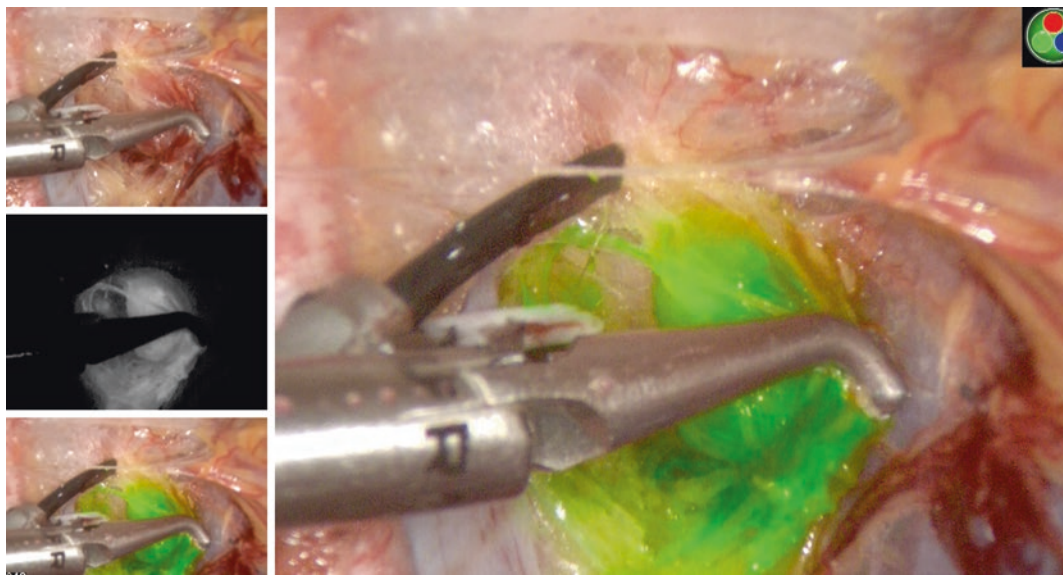

Fig. 7.3 Further dissection toggling between fluorescence and standard camera modes allows for safe isolation and retrieval of the sentinel lymph node

Pelvic Lymphadenectomy

When indicated, a complete pelvic lymphadenectomy is performed and includes removal of obturator and common, external, and internal iliac nodes. Lymphadenectomy can be performed via an extraperitoneal or, more commonly, transperitoneal approach at the time of initial surgery. When performed transperitoneal, the camera is placed in the umbilical port for optimal view of the pelvic sidewall. The pararectal and paravesi-

cal spaces are developed. The superior vesical artery is isolated and followed back to its origin from the common iliac artery, where nodal tissue is then dissected off bluntly or using electrosurgery. Next, the obturator space is explored, and the nodal bundle is released only once the obturator nerve is identified and dissected away from the lymph node packet. Finally, the external iliac artery is identified, and the nodal tissue overlying it is dissected, with careful attention paid not to transect the genitofemoral nerve running medially on the psoas muscle. Medial displacement of the ureter, which crosses at the bifurcation of the common iliac artery, is crucial for avoiding ureteral injury during lymphadenectomy.

Para-aortic Lymphadenectomy

For para-aortic lymphadenectomy, we recommend the primary surgeon stand between the patient's legs with the camera placed in the umbilical port turned cephalad. This allows for improved access to the superior border of the para-aortic dissection, the inferior mesenteric artery. To start, the peritoneum is dissected cephalad, and the first bundle of nodes along the lower abdominal aorta is removed. Continuing to move upward, the vena cava is visualized and its nodal bundle is separated. Continuing cephalad, the aortocaval nodes are removed after identification of the ureter to avoid injury.

Cervical Cancer

Indications for Laparoscopic Surgery in Cervical Cancer

Standard-of-care management for early-stage cervical cancer, including stages IA1 (with lymphovascular space invasion [LVSI]), IB1, IB2, and select IB3–IIA1 cervical cancers, involves radical hysterectomy with pelvic lymphadenectomy. In contrast to simple hysterectomy, radical hysterectomy entails removal of 1–2 centimeters of the upper vagina as well as the parametrium, including parts of the cardinal and uterosacral ligaments. While both open and laparoscopic techniques were previously considered acceptable for performing radical hysterectomy in cervical cancer, the most recent 2021 NCCN guidelines recommend laparotomy as the standard approach [13]. This recommendation is based on several retrospective and epidemiologic studies in addition to the phase III, randomized, controlled Laparoscopic Approach to Cervical Cancer (LACC) trial, which showed minimally invasive radical hysterectomy was associated with lower rates of disease-free and overall survival compared to an open abdominal approach [14–17]. As such, the application of laparoscopic hysterectomy is currently limited in patients with cervical cancer and primarily reserved for adenocarcinoma in situ (AIS) and IA1 disease without LVSI.

Ovarian Cancer

Indications for Laparoscopic Surgery in Ovarian Cancer

The application of laparoscopy for the management of ovarian cancer is currently controversial. Based on the 2021 NCCN guidelines, open laparotomy remains the recommended approach for the majority of ovarian cancer patients undergoing surgical staging, primary or interval debulking, and secondary cytoreductive surgery [18]. That said, results from a large, multicenter retrospective study suggested laparoscopy may be safely applied for the staging and management of early-stage disease. Specifically, among 300 patients who underwent either immediate or delayed laparoscopic staging surgery for presumed early-stage ovarian cancer, the disease-free survival, overall survival, and recurrence rates were comparable to those reported in the literature for laparotomy [19]. A direct comparison between both surgical approaches has not yet been made.

In the absence of prospective clinical trials directly comparing minimally invasive versus open techniques in ovarian cancer, the application of laparoscopy for ovarian cancer remains lim-

ited. Specific concerns regarding a laparoscopic approach to ovarian cancer management include an inadequate survey of the abdominal cavity, loss of tactile sensation important for the detection of sites of metastatic disease, and risk of tumor dissemination, among several others. The Minimally Invasive Interval Debulking Surgery in Ovarian Neoplasm (MISSION) trial studied laparoscopic cytoreduction for interval debulking surgery in patients after a clinically complete response to neoadjuvant chemotherapy [20]. The findings suggest that a minimally invasive technique for performing interval total hysterectomy, bilateral salpingo-oophorectomy, omentectomy, and pelvic or upper peritonectomy, with or without bowel resection as indicated, is safe and feasible in select patients, although survival data has not yet fully matured for interpretation. Further research and particularly prospective trials assessing the application of minimally invasive surgery in ovarian cancer are needed. Current data suggests there may be a role for laparoscopy in appropriately selected patients.

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