CHAPTER 7

Abdominal Radical Hysterectomy

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According to National Comprehensive Cancer Network (NCCN) guidelines, radical hysterectomy is the preferred treatment for patients with histologically confirmed stage IB1 to IIA1 cervical cancer who are not interested in future fertility.[1] Radical hysterectomy requires comprehensive knowledge of pelvic anatomy and the relationship among vital structures such as the rectum, ureters, bladder, and pelvic vasculature and the vast pelvic neural network. The aim of this chapter is to present an overview of various topics of interest on radical hysterectomy, including indications for the procedure, preoperative workup, surgical approaches, a detailed description of surgical technique, and management of complications.

History of Radical Hysterectomy

The first radical hysterectomy was performed by John Clark and Emil Ries at Johns Hopkins Hospital. Subsequently, Ernest Wertheim performed his first radical hysterectomy in 1898, and later, in 1911, he published the largest series at the time, on the abdominal approach, with more than 500 patients included in that report. The reported mortality rate and 5-year cure rate were 18.6% and 42.4%, respectively.[2] In 1908 Schauta published the results of 564 vaginal radical hysterectomies, with a mortality rate of 10.8% and a 5-year cure rate of 39.7%.[3]

In 1921 Hidekazu Okabayashi described a more radical procedure, dissecting the ureters completely from their peritoneal attachment, allowing a broader lateral parametrial resection.[4] Subsequently, in 1944 Alexander Meigs published his experience with radical hysterectomy and proposed that, given the high failure rates associated with radiotherapy at the time, radical hysterectomy should be the primary approach to patients with cervical cancer.[5] In 1961 Kobayashi introduced the concept of nerve-sparing radical hysterectomy with a technique that involved a very detailed dissection of the hypogastric nerve in the medial leaf of the broad ligament, with a focus on sparing this structure and ensuring its bilateral preservation. This procedure had as its primary goal the prevention of postoperative bladder complications.[6] Over the past 20 years, a laparoscopy or robotic approach has become increasingly more popular in the management of early-stage cervical cancer. Descriptions of the first laparoscopic and robotic radical hysterectomy (RRH) procedures were published in 1992[7] and 2006,[8] by Nezhat and colleagues and Sert and Abeler, respectively. These minimally invasive approaches have shown benefit to the patient in terms of lower postoperative complication rates and faster return to daily activities. To date, there has been no prospective randomized trial that has evaluated whether minimally invasive surgery offers an advantage over laparotomy in the management of cervical cancer. An ongoing prospective randomized trial (LACC [Laparoscopic Approach to Cervical Cancer] trial) will, it is hoped, shed light on this question.[9]

Classification of Radical Hysterectomy

The most recent classification of radical hysterectomy was published by Querleu and Morrow.[10,11] In applying such a classification, several elements should be noted. These include the extent of parametrial resection and the three parts of the parametria—anterior or ventral, posterior or dorsal, and lateral—with clear limits and landmarks for identification (see the discussion of surgical technique later in this chapter). The radicality may be different on each side of the pelvis, according to tumor growth or clinical presentation. One of the most important features offered by this classification system is that there are anatomic landmarks that must be recognized, in a reproducible way, thus allowing surgeons a uniformity in the approach to the procedure.

Type A Radical Hysterectomy

Type A radical hysterectomy corresponds to the extrafascial hysterectomy, which allows full removal of the pericervical tissue up to the attachment of the vaginal fornices.

The ureter does not need to be unroofed. In this type of radical hysterectomy, the surgeon is not required to resect the ventral or lateral parametria, nor the dorsal parametria. The hypogastric plexus, therefore, remains fully preserved.

Type B Radical Hysterectomy

Type B radical hysterectomy corresponds to the modified radical hysterectomy. Identification of autonomic nerves is not required, and the hypogastric plexus is fully preserved. With regard to the ventral parametria, the ureter is unroofed only in its course through the parametria, allowing for the resection of only a small initial part of the medial leaf of the ventral parametria. In the lateral parametria, as the ureter is unroofed, dissected from the cervix, and displaced laterally (but not dissected from the lateral or ventral parametria), the resection margin is at a medial aspect of the ureteral bed, thus allowing for the horizontal resection of about 1 to 1.5 cm of the lateral parametria. The ureteral artery, branching from the uterine artery at its crossing of the ureter, can serve as a helpful landmark and is usually easily identified and can be spared. The longitudinal (deep parametrial or vertical) resection limit is formed by a tangential plane of the vaginal cuff resection. In the dorsal parametria, the type B radical hysterectomy aims for horizontal resection of 1 to 2 cm dorsally from the cervix. The resection line corresponds to the amount of lateral parametria removed. Longitudinally, the margin of resection is at the level of the vaginal cuff; however, it is important not to dissect below the course of the ureter because this is where one will find the branches of the hypogastric plexus.

Type C Radical Hysterectomy

The Morrow and Querleu classification distinguishes between a type C1 procedure, which corresponds to the nerve-sparing modification, and the type C2 procedure, which aims for a complete parametrial resection. There are significantly distinct resection margins between the two types, particularly in the longitudinal (deep parametrial or vertical) dimension, which are determined by the course of the main branches of the inferior hypogastric plexus in the type C1 procedure.

Type C1 requires separation of two parts of the dorsal parametria: the medial part, which entails rectouterine and rectovaginal ligaments, and the lateral laminar structure, also called *mesoureter,* which contains the hypogastric plexus. Furthermore, type C1 requires only a partial dissection of the ureter from the ventral parametria, which is usually asymmetric toward more extensive resection of the medial leaf of the cranial (above the ureter) part of the ventral parametria. In the type C2 procedure, the ureter is completely dissected from the ventral parametria up to the urinary bladder wall. Defining the resection limits on the longitudinal (deep parametrial or vertical) plane is crucial for distinguishing between types C1 and C2.

With regard to ureteral dissection, in the type C1 procedure the ureter is unroofed and dissected from the cervix and from the lateral parametria but only partially from the ventral parametria (1–2 cm). The type C2 procedure requires complete dissection of the ureter from the ventral parametria up to the bladder wall.

Lateral Parametria—Transverse (Horizontal) Resection Margins

- C1 and C2: The lateral border is identical for both types, formed by the medial aspect of the internal iliac vein and artery.

Longitudinal (Deep Parametrial or Vertical) Resection Margins

- C1—vaginal vein (deep uterine vein): The deep parametrial resection margin is formed by the vaginal vein; thus the caudal part of the lateral parametria containing the splanchnic nerves is preserved.
- C2—pelvic floor (sacral bone): The resection line continues alongside the medial aspect of the internal iliac vessels and pudendal vessels caudally up to the pelvic floor. The pararectal and paravesical spaces are completely unified; the splanchnic nerves in the caudal part are sacrificed. Such deep resection allows for greater mobility of the lateral parametria, facilitating its complete removal.

Ventral Parametria—Transverse Resection Margins

- C1: Partial dissection of the ureter from the ventral parametria allows for resection of 1 to 2 cm of the ventral parametria.
- C2—urinary bladder wall: Complete dissection of the ureter from the ventral parametria is required, which allows for complete removal of the ventral parametria up to the urinary bladder wall; both medial and lateral leaves of the ventral parametria are resected equally.

Longitudinal Resection Margins

- C1: The resection line is formed by bladder branches of the hypogastric plexus located below the course of the ureter.
- C2: The resection line is formed by the level of the paracolpium and vaginal resection. Both cranial and caudal (below the ureter) parts of the ventral parametria are removed. Bladder branches of the hypogastric plexus are sacrificed; thus their identification is not required.

Dorsal Parametria—Transverse Resection Margins

- C1 and C2: The dorsal border is identical for both types, formed by the rectouterine ligament attachment to the rectum.

Longitudinal Resection Margins

- C1: Sagittal dissection of the hypogastric nerves from the rectouterine and rectovaginal ligaments is performed. The main branches of the hypogastric plexus must be preserved on the lateral part (mesoureter); the caudal limit of the rectouterine and rectovaginal ligaments is formed by the tangential plane of the vaginal cuff resection.
- C2: Complete resection of the dorsal parametria is performed deeply below the rectal attachment; thus branches of the hypogastric plexus are sacrificed.

Type D Radical Hysterectomy

Type D radical hysterectomy differs from type C2 radical hysterectomy only in the lateral extent of the lateral parametrial resection. Ureteral dissection and resection of both dorsal and ventral parametria are identical to those in the type C2 procedure. Laterally, however, the type D procedure entails ligation and removal of the internal iliac artery and vein, together with their branches, including the gluteal, internal pudendal, and obturator vessels.

Lateral parametrial resection requires ligation of the internal iliac artery and vein. Their removal, together with their branches in the lateral parametria, allows for further lateral extension of the resection. The lateral resection line is formed by the lumbosacral nerve plexus, piriformis muscle, and obturator internal muscle. This type of radical hysterectomy is rarely performed for locally advanced tumors.

Indications for Radical Hysterectomy

Currently, only patients with early-stage disease are considered ideal candidates for radical hysterectomy. The most common indications for abdominal radical hysterectomy (ARH) include the following:

- Stage IA1 cervical cancer with lymphovascular space involvement
- Stage IA2 cervical cancer in patients not interested in fertility preservation
- Stage IB1 cervical cancer
- Stage IIA1 cervical cancer
- After chemotherapy or radiotherapy for locally advanced disease (usually IIB cervical tumors)
- Stage II endometrial cancer

Preoperative Evaluation

The staging for cervical cancer remains a clinic staging system, and thus all preoperative evaluation relies on use of a nonsurgical approach. The preoperative evaluation must include a thorough pathologic review by an expert in gynecologic malignancies. Routine preoperative blood work should include a complete blood count and chemistry profile, including renal and liver function tests. NCCN guidelines do not routinely recommend imaging studies other than a chest radiograph. However, whenever there is suspicion of metastatic disease, the patient should undergo computed tomography (CT) or magnetic resonance imaging (MRI). The accuracy in detection of metastatic nodal disease ranges from 83% to 90% for CT and from 86% to 90% for MRI; positron emission tomography–computed tomography (PET-CT) has a sensitivity of 75% to 100% and a specificity of 87% to 100%.[12]

Use of MRI has been proposed by a number of authors to rule out parametrial involvement in early-stage cervical cancer. Sensitivity ranges from 38.0% to 100% and specificity from 61.5% to 99.0%.[13,14] In a recently published paper, in 303 patients with stage IB or IIA cervical cancer treated with adjuvant radiotherapy or concurrent chemoradiotherapy following primary surgery for whom MRI scans were available, the authors reported a sensitivity and specificity of MRI for detecting parametrial involvement of 53.8% and 82.1%, respectively. Positive and negative predictive values were 38.4% and 89.6%, respectively. The accuracy of MRI for detecting parametrial involvement was 77.2%. There were 45 false-positive (14.9%) and 24 false-negative (7.9%) results. The authors concluded that MRI did not show enough reliability to predict parametrial involvement status, and the prognosis was not affected by the MRI results.[15] In summary, routine imaging in patients undergoing radical hysterectomy is not recommended unless there is high suspicion of metastatic disease (e.g., patients with tumors larger than 4 cm or those with high-risk histologic types such as serous carcinoma, carcinosarcoma, or neuroendocrine tumors).

Surgical Approach

In performing a radical hysterectomy, there are several possible approaches, and which is used depends on innumerable factors. These include but are not limited to surgeon experience, patient preference, equipment availability, and patient body habitus. Different approaches by which radical hysterectomy can be performed include:

- Laparoscopic-assisted vaginal radical hysterectomy (LAVRH)
- Abdominal radical hysterectomy (ARH)
- Laparoscopic radical hysterectomy (LRH)
- Robotic radical hysterectomy (RRH)

Laparoscopic-Assisted Radical Vaginal Hysterectomy

LARVH is a procedure in which all dissections in the pelvic spaces, identification of landmarks, and radical resection are done via the vaginal route, according to the classic description of Schauta.[3] The laparoscopic portion of the procedure is used to perform the pelvic lymphadenectomy and occasionally resection of the adnexa. On completion of the lymphadenectomy, the surgeon will proceed with the vaginal portion of the procedure. Because of the fact that extensive training in radical vaginal surgery is needed, this procedure is rarely performed, and only a small number of centers routinely use this approach.

In a recently published meta-analysis,[16] Zhang and coworkers compared the results in 349 women who underwent LARVH and 445 women who underwent ARH. The analysis examined seven publications (four reports from prospective cohort studies and three from case-control studies). LARVH was associated with less blood loss (weighted mean difference [WMD], −237.45; 95% confidence interval [CI], −453.42 to −21.47), fewer wound-related complications (odds ratio [OR], 0.17; 95% CI, 0.05–0.61), shorter hospital stay (WMD, −2.01; 95% CI, −2.52 to −1.51), and longer operative time (WMD, 48.95; 95% CI, 42.08–55.82) versus ARH. There were no statistical differences with regard to number of lymph nodes retrieved, urinary-related complications, rectal injury, lymphedema, and oncologic outcomes.

Abdominal Radical Hysterectomy

Radical hysterectomy is the preferred treatment in the surgical management of patients with early-stage cervical cancer, and its cure rate (in the absence of indications for adjuvant therapy) is over 90%.[17,18] Radical hysterectomy offers several advantages over radiotherapy in that it preserves ovarian function in young patients, it allows for direct evaluation of the lymph nodes, it does not affect functional vaginal length, and it is associated with an acceptable morbidity profile. In a meta-analysis comparing three techniques of radical hysterectomy (abdominal, laparoscopic, and robotic), the authors examined 47 articles: 21 studies (1339 patients) of LRH, 14 studies of open radical hysterectomy (1552 patients), and 12 studies of RRH (327 patients). Mean sample size, age, and body mass index across the three types of radical hysterectomy studies were similar. Mean operation time across the three types of radical hysterectomy studies was comparable. Mean blood loss and transfusion rates were significantly higher in ARH compared with both LRH and RRH. Length of hospital stay associated with RRH was significantly shorter than with the other two methods. The mean number of lymph nodes obtained, rate of nodal metastasis, and positive margins across the three types of approaches were similar. Postoperative infectious morbidity was significantly higher among patients who underwent ARH compared with the other two methods, and a higher rate of cystotomy was noted in the LRH group. The authors concluded that minimally invasive surgery, especially RRH, may be a better and safe option for surgical treatment of early-stage cervical cancer.[19]

Laparoscopic Radical Hysterectomy

The first LRH was described in 1992.[7] To date, more than 1500 procedures have been reported in several case series in literature.[20,21]

Among the advantages of the laparoscopic approach are less blood loss, lower transfusion rates, better cosmetic results, lower rates of adynamic ileus, faster return of bowel function, and overall faster recovery. A recent report also featured the safety and feasibility of outpatient radical hysterectomy by the laparoscopic approach.[22]

Robotic Radical Hysterectomy

The first RRH was reported in 2006 by Sert and Abeler.[8] To date, more than 1000 cases have been reported in the literature.[23] In a meta-analysis of 26 nonrandomized studies (10 studies comparing RRH and ARH, 9 studies comparing RRH and LRH, and 7 studies comparing all three approaches) including a total of 4013 women (1013 RRH, 710 LRH, and 2290 ARH). RRH was associated with less estimated blood loss (WMD, 384.3; 95% CI, 233.7–534.8) and shorter hospital stay (WMD, 3.55; 95% CI, 2.10–5.00) than ARH. RRH was also associated with lower odds of febrile morbidity (OR, 0.43; 95% CI, 0.20–0.89), blood transfusion (OR, 0.12; 95% CI, 0.06–0.25), and wound-related complications (OR, 0.31; 95% CI, 0.13–0.73) compared with ARH. RRH was comparable to LRH with regard to all intraoperative and postoperative outcomes. The authors concluded that RRH may be superior to ARH with lower estimated blood loss, shorter hospital stay, less febrile morbidity, and fewer wound-related complications. RRH and LRH appeared equivalent in intraoperative and short-term postoperative outcomes, and thus the choice of approach can be tailored to the patient and surgeon.[23]

Surgical Assessment and Technique

In preparation for the surgical procedure, all patients should undergo prophylactic antibiotics as recommended in the guidelines of the American College of Obstetricians and Gynecologists (ACOG).[24] An open radical hysterectomy should be considered a “clean-contaminated” operation. It is important to ensure that all measures are taken to prevent thromboembolic events. These include routine use of pneumatic compression stockings. Use of preoperative heparin remains a subject of debate, although many centers elect for a standard dose (5000 units subcutaneously) of unfractionated heparin 2 hours before the procedure.

Type of Incision

The abdominal incision depends on the surgeon’s preference and training; choices include a standard vertical incision, a Pfannenstiel incision, a Maylard incision, or a Cherney incision. The vertical incision is likely the fastest and the one to offer the greatest access to the upper abdomen. There is no evidence that a lower transverse incision limits exposure, but the choice of each of these is certainly a matter of the surgeon’s preference. The Maylard and Cherney incisions offer the advantage of great exposure to the lateral pelvic sidewall; however, the former may be associated with a greater degree of postoperative pain, because the rectus muscle must be transected. In addition, with the Maylard incision the inferior epigastric vessels may potentially be sacrificed. The Cherney incision offers the advantage that the rectus muscle and its vasculature remain intact, but, given the fact that the muscle must be severed from its aponeurosis to the pubic bone, this incision may be associated with osseous infectious complications.

Unexpected Nodal Disease

On entry into the abdominal and pelvic cavity, a thorough evaluation must be performed to ensure that no metastatic disease is found. When there is suspicion of metastatic disease (nodal or peritoneal), a biopsy should be performed and the specimen sent for frozen section evaluation. There is no consensus in the literature regarding how to proceed in this clinical scenario. In 2010, Gray and colleagues[25] published a retrospective study including 268 women with early-stage (IA2–IIA) cervical cancer, of whom 19 (7%) had an abandoned hysterectomy for grossly positive lymph nodes (84%) or pelvic spread of tumor (16%). These patients were compared with 44 patients with evidence of nodal involvement found after surgical intervention; both groups received adjuvant radiotherapy or chemoradiotherapy treatment. There were no differences in major morbidities between groups: 26% versus 34% (OR, 0.69; CI, 0.16–2.57; P = .789) in the abandoned and completed surgical groups, respectively. The recurrence rate was 37% versus 18% (P = .168) between the abandoned and completed surgical groups. Overall survival in the abandoned surgical group was 73% versus 80% in the completed surgical group (P = .772). The author’s conclusion was that abandoning a planned radical hysterectomy for unexpected metastatic disease may not worsen the outcome. Potter and colleagues[26] compared 15 patients with stages IB and IIA invasive cervical cancer whose radical hysterectomies were aborted solely for reasons of pelvic lymph node involvement with a control group of 15 patients matched for tumor size and number of lymph nodes involved in whom radical hysterectomies were completed. Both groups were treated with radiation therapy (RT) postoperatively. Survival and local control were not different between groups (P = .81 and P = .127, respectively). The authors concluded that if RT is anticipated, completion of radical hysterectomy followed by RT appears to offer no advantage over RT with the uterus in place in patients with early-stage invasive cervical cancer and pelvic lymph node involvement. Leath and colleagues[27] published a study that included 23 patients with cervical cancer in whom a radical hysterectomy was aborted (17 patients with stage IB1 disease, 4 with stage IB2, and 2 with stage IIA). The reasons for aborting the procedure were as follows: 11 patients had pelvic extension, 7 had positive pelvic nodes, and 5 had positive paraaortic nodes. All 23 patients received postoperative RT; in addition, 12 patients received concurrent chemotherapy consisting of platinum with or without 5-fluorouracil (5-FU). Four patients (17%) had radiation-associated complications. Six of 23 (26%) patients experienced a recurrence. The 5-year overall survival rate was 83%, with a median follow-up period of 59 months (range, 12–107 months). The authors concluded that an aborted radical surgical procedure does not significantly increase overall complications and that these patients still have a favorable prognosis with postoperative RT.

In 2005, Suprasert and colleagues[28] evaluated the outcomes of patients with stage IB to IIA cervical cancer whose radical hysterectomy was abandoned because of positive pelvic nodes detected during the operation compared with those found to have positive nodes after the operation at final pathologic evaluation. Among 242 patients with planned radical hysterectomy and pelvic lymphadenectomy (RHPL), 23 (9.5%) patients had grossly positive nodes. Radical hysterectomy was abandoned, and complete pelvic lymphadenectomy was performed. Of these 23 patients, 22 received adjuvant chemoradiation, and the remaining patient received adjuvant radiation alone. Four patients with positive paraaortic nodes were additionally treated with extended-field irradiation. When compared with 35 patients whose positive nodes were detected after the operation, complications in both groups were not significantly different, but the 2-year disease-free survival was significantly lower in the abandoned radical hysterectomy group compared with the RHPL group (58.5% vs. 93.5%, $P < .01$). The authors concluded that the survival of patients with stage IB to IIA cervical cancer whose radical hysterectomy was abandoned because of grossly positive pelvic nodes was significantly worse than that of patients whose node metastasis was identified after the operation. The reason suggested by the authors for this finding was that the patients in the abandoned radical hysterectomy group had worse prognostic factors. In 2000, Whitney and colleagues[29] aimed to evaluate the frequency with which intended radical hysterectomy for cervical cancer is abandoned and the outcomes in those patients. A secondary evaluation of a prospective surgical pathologic trial was performed. There were 1127 patients with stage IB carcinoma of the cervix entered in Gynecologic Oncology Group Protocol 49. These patients were to undergo RHPL with analysis of pathologic findings, complications, and outcomes. At operation, 98 women had extrauterine disease and the proposed radical operation was abandoned at the discretion of the operating surgeon. Subgroups of patients with extrapelvic disease (30) and pelvic extension (26), including grossly positive pelvic nodes (12), other pelvic implants (8), and gross serosal extension (2), were identified. Sixty-three (93%) patients subsequently underwent pelvic RT and one or two intracavitary applications. Paraaortic fields were added for eight patients who were found to have positive paraaortic nodes. Five patients received radiotherapy and chemotherapy; four patients received chemotherapy alone. One patient declined any further therapy. The disease-free survival was shorter for patients whose radical procedure was abandoned than for patients who underwent radical hysterectomy. Among the abandoned operation patients, those with extrapelvic disease had the shortest progression-free interval and survival. The authors concluded that the morbidity of the radical hysterectomy is low even when followed by RT. However, no recommendations for optimal therapy can be made from this analysis. Richard and colleagues[30] published an article based on the Surveillance, Epidemiology, and End Results (SEER) Program database from 1988 to 1998. They compared the 5-year survival rates for women with apparently early-stage cervical cancer who had undergone completed versus abandoned radical hysterectomy and had been treated with postoperative RT. Women with positive lymph node involvement who had undergone a complete pelvic and paraaortic lymphadenectomy were compared for 5-year survival based on whether a radical hysterectomy was completed or abandoned at the time of operation. All women received postoperative RT. From a cohort of 3116 women diagnosed with stage IB cervical cancer, 265 (8.5%) had positive pelvic lymph nodes and underwent a complete pelvic and paraaortic lymphadenectomy. Of these women, in 163 the radical hysterectomy was completed, whereas it was abandoned in 55. Positive pelvic lymph nodes averaged 2.58 ± 2.37 in the completed radical hysterectomy group and 2.42 ± 1.63 in the abandoned radical hysterectomy group. Median follow-up was 6.42 years in the completed radical hysterectomy group and 5.75 years in the abandoned radical hysterectomy group. Five-year survival for the completed radical hysterectomy group was 69% compared with 71% in patients with abandoned radical hysterectomy ($P = .46$). The authors concluded that the treatment for patients with positive pelvic lymph nodes at the time of radical hysterectomy should be determined by overall morbidity

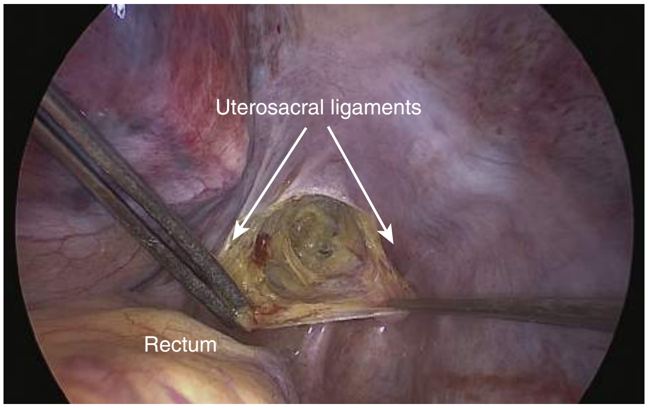

FIG. 7.1 Opening the pouch of Douglas.

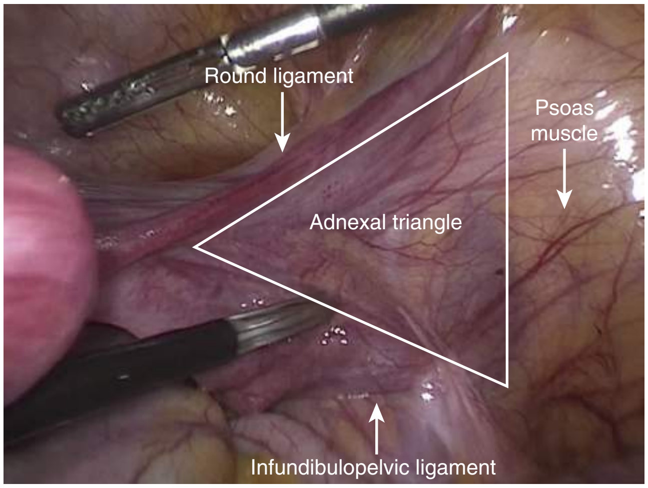

FIG. 7.2 Adnexal triangle landmarks.

of therapy because equivalent 5-year survival rates were found between the completed and abandoned radical hysterectomy groups.

Step-by-Step Approach to Abdominal Radical Hysterectomy

Development of the Rectovaginal Space (Fig. 7.1)

Although there are several options in the sequence of the steps in performing an ARH, one of them is to begin the procedure by developing the rectovaginal space. The reasons for doing so include the following:

- To protect and isolate the rectal wall. This is useful when adhesions are present at this level or in case of endometriosis.
- To identify the posterior vaginal wall. Once the posterior vaginal wall has been identified, the posterior resection margin is identified.
- To define the limits of the uterosacral ligaments and also to facilitate finding the hypogastric nerve.

Development of the Pelvic Spaces

The adnexal triangle is formed by the round ligament, the infundibulopelvic ligament, and the psoas muscle (Fig. 7.2). The first structure that should be identified is the superior vesical artery,

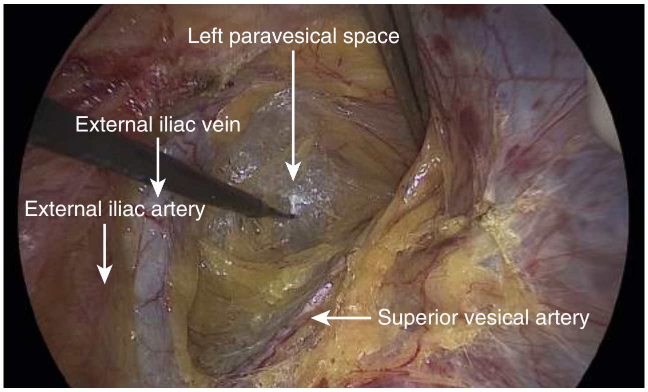

FIG. 7.3 Left pelvic side, initial view.

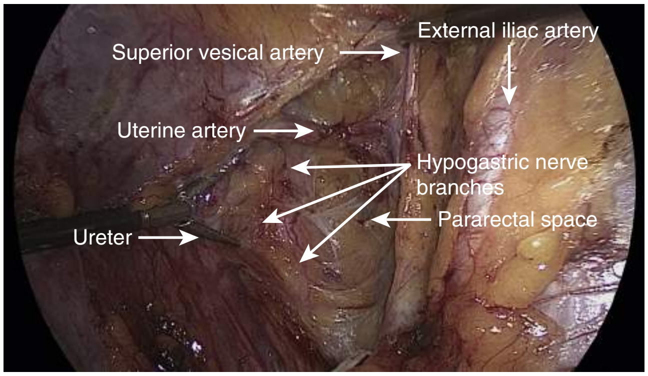

FIG. 7.5 Right pararectal space—vessels.

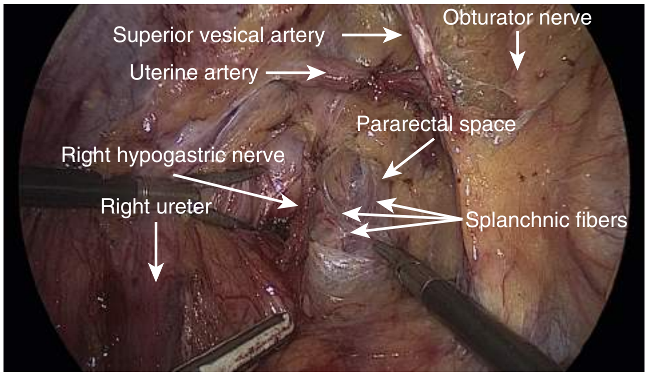

FIG. 7.4 Right pararectal space—nerves.

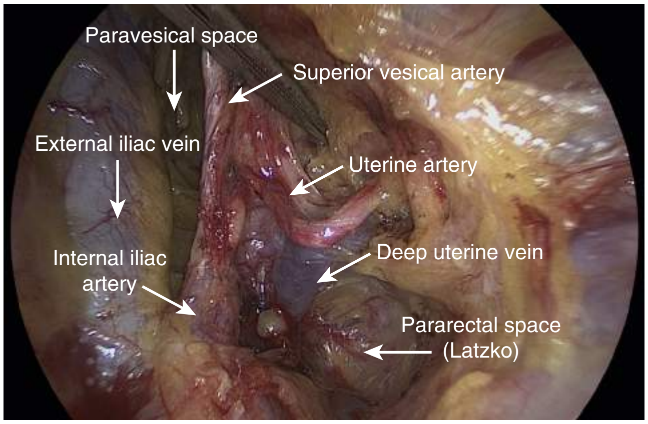

FIG. 7.6 Left pelvic spaces—landmarks.

which lies medially, attached to the medial peritoneal fold. The space located lateral to this structure is the paravesical space. This space is limited medially by the superior vesical artery, laterally by the iliac vessels, anteriorly by the pubic bone, and posteriorly by the cardinal ligament. At the floor of this space, one should identify the fibers of the levator ani muscles. Development of the paravesical space allows for excellent exposure of the pelvic lymph nodes (Fig. 7.3).

The next step is the development of the pararectal space. This space is bound medially by the ureter, the posterior leaf of the broad ligament, and the uterosacral ligaments; laterally by the internal iliac artery; posteriorly by the sacral fascia; and anteriorly by the uterine vessels. This space is also known as the Latzko space. The uterine vessels must be carefully dissected from their origin in the hypogastric artery. One should note that in some cases there are two vascular structures together, the uterine artery and the superficial uterine vein, usually in a parallel position. The surgeon can identify the hypogastric nerve approximately 4 to 5 cm below the artery and attached to the peritoneum; this nerve lies in the inferior aspect of the pararectal fossa (Figs. 7.4–7.6).

With careful dissection, the surgeon can observe the branches of splanchnic nerves crossing the pararectal fossa to join the hypogastric nerve; together they will transform, below the deep uterine vein, into the inferior hypogastric plexus. At this point in the operation, the surgeon has dissected the first two spaces of the pelvis, and the pelvic side wall anatomy should be completely exposed.

The next step is identification and separation of the ureter from its attachment to the posterior leaf of the broad ligament. One must pay careful attention to ensure that the vasculature of the ureter is not disrupted. The ureter must be separated from the peritoneum with gentle dissection. Once this step has been completed, the Okabayashi space will be exposed. Its limits are the medial leaf of the broad ligament, the ureter laterally, the deep uterine vein anteriorly, and the sacral fascia posteriorly. The deepest part of this space should be the branches of the hypogastric nerve (see Fig. 7.5). The ureter should be dissected distally to the point below the uterine artery to facilitate the dissection of the parametria.

At this point in the operation, the following anatomic landmarks should be identified:

- superior vesical or obliterated umbilical artery
- round ligaments
- uterine artery
- hypogastric artery
- obturator nerve
- hypogastric nerve
- ureter
- ureteral tunnel
- deep uterine vein
- paravesical space
- inner and outer pararectal spaces (Figs. 7.6 and 7.7)

Bladder Dissection

With the assistant placing upward traction on the uterus (if abdominal) or pushing upward with the uterine manipulator (if laparoscopic or robotic), the bladder fold should be identified. The peritoneum overlying the bladder should then be transected and opened, providing exposure to the uterovesical space. With gentle dissection, the bladder may be separated

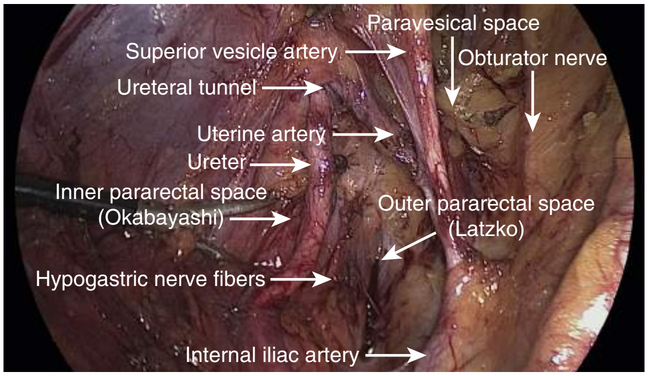

FIG. 7.7 Full dissection, right pararectal space.

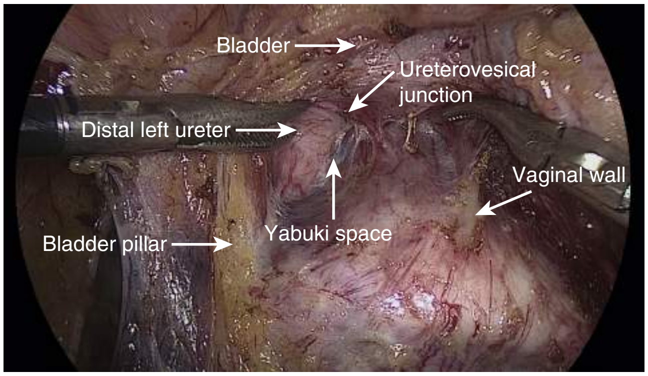

FIG. 7.9 Yabuki space (fourth space).

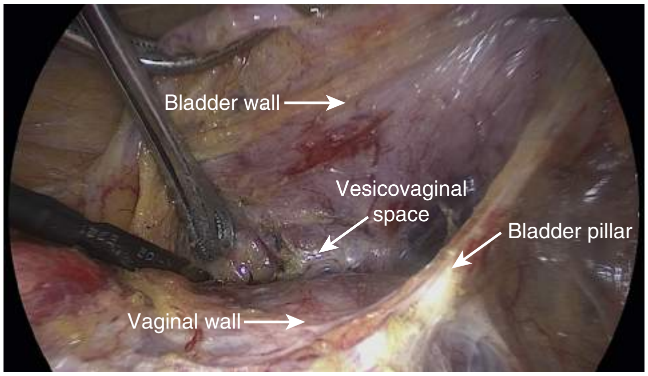

FIG. 7.8 Vesicovaginal space dissection.

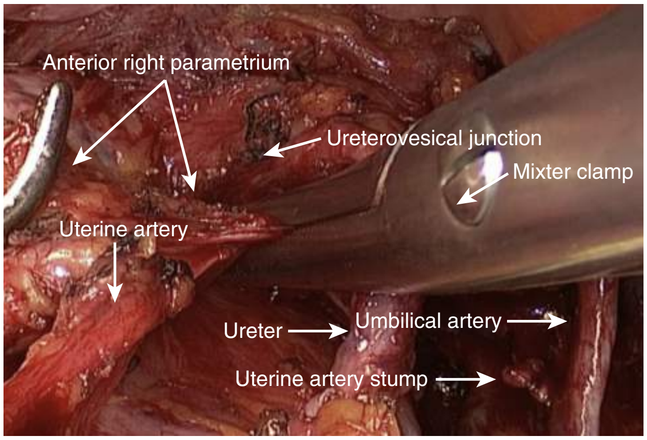

FIG. 7.10 Right anterior parametrium transection.

from the anterior vaginal wall. The most important part of this step is identification and development of the Yabuki space.[31] The limits of the Yabuki space are the ureter laterally as it enters the bladder; the lateral vaginal wall medially; the bladder anteriorly; and the endocervical fascia and the uterine vessels entering into the uterus at its isthmus, posteriorly. This space is located laterally, below the bladder pillars. Once this space has been opened, one can see the distal part of the ureter entering the bladder (Figs. 7.8 and 7.9).

One should not dissect deeper than this space because the deep uterine vein may be easily injured. This step allows the surgeon to define the anterior vaginal resection margin. If a laparoscopic procedure is being performed, the cup of the uterine manipulator may be seen at this point, and the resection margin can be defined.

Uterine Artery Ligation and Unroofing of Ureter

The uterine artery must be ligated at its origin from hypogastric artery. Once this has been done, the uterine artery should be lifted and the dissection below the artery should continue. With medial traction on the uterine vessels, the surgeon must unroof the ureter. If performing a radical hysterectomy by laparoscopy, the surgeon must try to avoid contact between the vessel sealing device and the ureter. Thermal injury to the ureter at this point may lead to development of ureteral fistulas. When the uterine artery and its surrounding tissue are already separated from the ureter, bladder, and vaginal wall, the surgeon can see the ureterovesical junction, and the anterior parametria, which is then ligated (Fig. 7.10).

Parametrial Resection

To resect the parametria posteriorly, the surgeon must take care to separate and "lateralize" the hypogastric nerve before transecting the posterior aspect of the parametria. The hypogastric nerve is located 3 to 4 cm below the ureter, attached to the peritoneum of the posterior leaf of the broad ligament, and it tracks toward the bladder, passing behind and below the deep uterine vein, where together with splanchnic fibers it forms the inferior hypogastric plexus. It is very important to dissect the nerve in all its extension and to maintain it behind the deep uterine vein. Once the nerve has been dissected and isolated, the surgeon can cut the uterosacral ligaments (without including the neural structures). This is done to avoid bladder motility disorders. At this point in the procedure, the uterus is primarily attached to the lateral parametria and paravaginal tissue (paracolpium). When estimating the resection of the parametria, one must remember that the hypogastric nerve is the inferior margin of the resection. At this point, the uterus will be attached only to the vagina, and the surgeon should be sure to resect at least a 2-cm circumferential margin of the upper vagina (Figs. 7. 11 and 7.12). The vaginal cuff should be closed with absorbable sutures. If a laparoscopic technique is being performed, the vaginal cuff may be sutured with a running absorbable suture in one or two layers. Some surgeons may prefer to leave the vaginal cuff open to remove the nodal bundle of the pelvic lymphadenectomy through the vagina and subsequently proceed with closure. One should then confirm that both ureters are intact and that the hypogastric nerves are also intact. At this point the specimen should be examined for adequacy of resection (Figs. 7.13–7.15).

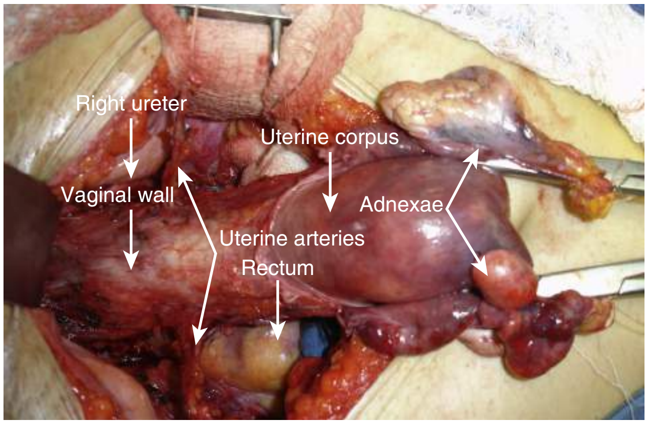

FIG. 7.11 Specimen before final resection.

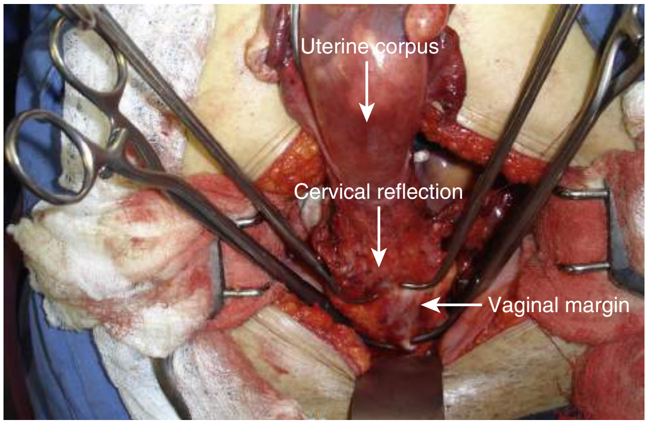

FIG. 7.12 Definition of vaginal resection margin.

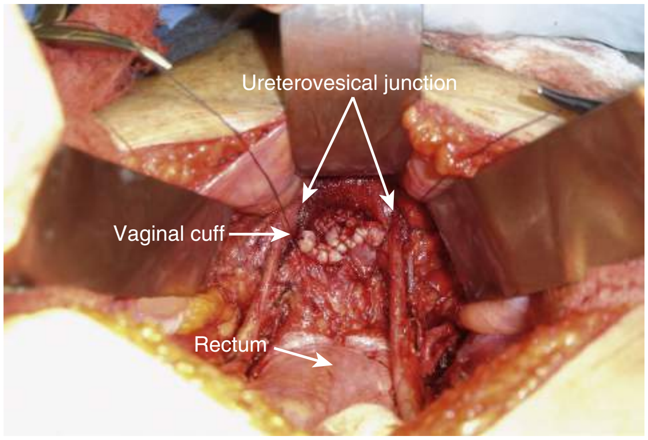

FIG. 7.13 Ureters entering into the bladder.

Pelvic Node Dissection

Pelvic lymph node status is the strongest predictor of oncologic outcome in patients with a diagnosis of cervical cancer. The overall 5-year survival rate among node-negative patients after radical hysterectomy is approximately 80% to 90%. However, when there is evidence of pelvic lymph node involvement, the survival rate drops significantly to approximately 30% to 60%.[17,18]

To date, the gold standard method to assess pelvic nodal status is comprehensive pelvic lymphadenectomy. However, a

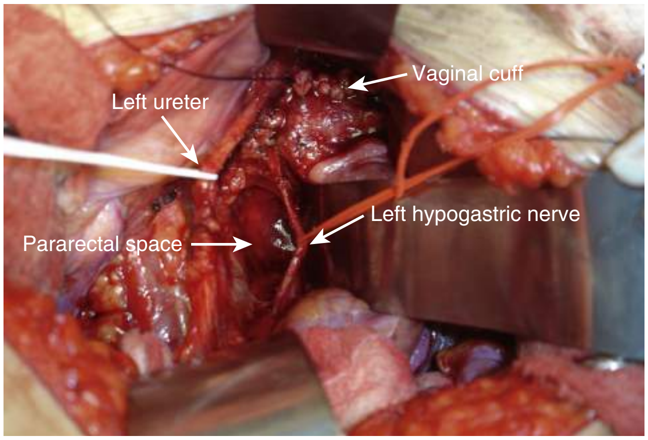

FIG. 7.14 Hypogastric nerve preserved after specimen resection.

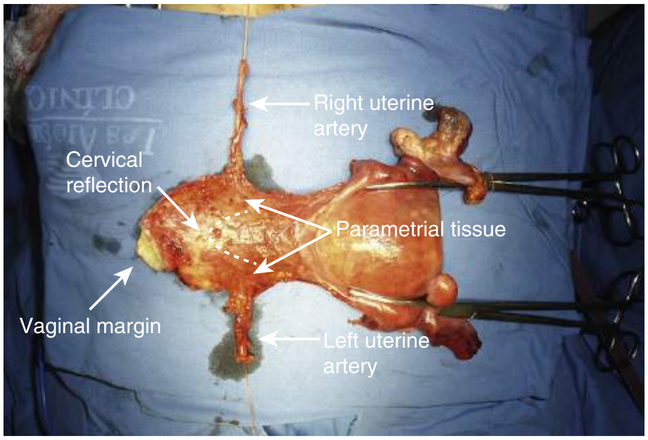

FIG. 7.15 Surgical specimen.

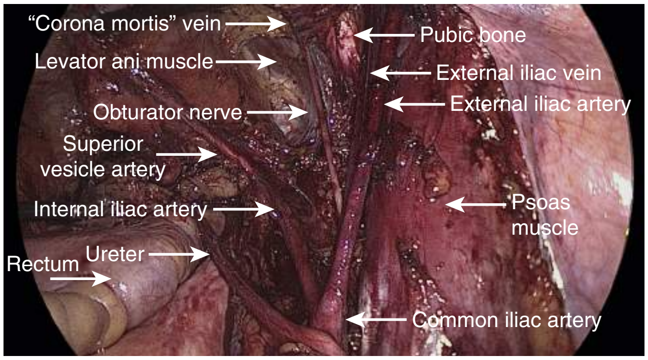

FIG. 7.16 Exposed right pelvic vessels after pelvic lymphadenectomy.

recent study by Salvo and colleagues[32] showed that the false-negative rate of sentinel lymph node mapping in patients with early-stage cervical cancer was 3.6%. This suggests that perhaps routine pelvic lymphadenectomy may not be necessary.

When a pelvic lymphadenectomy is performed, the anatomic boundaries are as follows: proximally, the bifurcation of the iliac vessels; distally, the circumflex iliac vein crossing over the distal iliac artery; laterally, the genitofemoral nerve; and medially, the iliac vessels. The most inferior portion of the dissection is the obturator nerve (Fig. 7.16). One should not use drains after pelvic lymphadenectomy because these have not been shown to decrease the rate of lymphocyst formation and may, in fact, increase the rate of infectious complications.[33]

Regarding bladder drainage, Wells and colleagues[34] published a retrospective analysis including 212 patients who underwent a radical hysterectomy (134 with TUCs vs. 78 with SPCs), comparing the two methods of bladder drainage. The authors found a higher rate of urinary tract infections (27%) in the TUC group compared with the SPC group (6%; $P < .001$); a shorter hospital stay favoring the SPC group (4.8 vs. 5.7 days; $P < .001$); and an earlier trial of voiding (2.7 vs. 4.4 days; $P < .001$) in the SPC group. The authors concluded that after a radical hysterectomy, suprapubic catheterization is associated with a lower rate of urinary infections and an earlier successful trial of voiding than transurethral catheterization. In another study, Naik and colleagues[35] reported a higher incidence of urinary infections in patients who were performing intermittent self-catheterization than in patients with SPCs (42% and 18%, respectively). Similarly, Van Nagell and colleagues[36] described a 44% rate of urinary tract infections in patients with TUCs compared with a rate of 23% in patients with SPCs.

Complications of Radical Hysterectomy

The overall complication rate after radical hysterectomy ranges from 26.7% to 50%.[37–39] In general, complications are categorized as occurring intraoperatively; occurring less than 30 days after surgery (early); and occurring more than 30 days after surgery (late).

Intraoperative Complications

During an open surgical procedure, injury of bladder, bowel, vascular structures, or nerves is a very rare event. The most common intraoperative complication of radical hysterectomy is bleeding. The reported rates of intraoperative blood loss range from 500 to 1500 mL.[40,41] The majority of blood loss during a radical hysterectomy occurs in general in the dissection of the anterior and lateral parametria. In a meta-analysis comparing three different techniques of radical hysterectomy, including 21 studies (1339 patients) of LRH, 14 studies (1552 patients) of open radical hysterectomy, and 12 studies (327 patients) of RRH, the median percentages of blood transfusion were 25%, 2.7%, and 0% for abdominal, laparoscopic, and robotic approaches, respectively. The rate of blood loss decreased significantly when minimally invasive approaches were used, with a median of 209 mL (range, 143–443 mL) and 133 mL (range, 50–355 mL) for laparoscopic and robotic approaches, respectively.[19]

Postoperative Complications

Among early postoperative complications, the more frequent are related to the urinary tract and its innervation. In general, there is a strong correlation with the amount of parametrial and paravaginal tissue removed during the operation. The reported incidence of lower urinary tract dysfunction after radical hysterectomy varies from 8% to 80%.[42,43] To avoid urinary complications, the surgeon must avoid extensive parametrial or paravaginal resection.

Lower urinary tract dysfunction after radical hysterectomy includes the inability to empty the bladder, dysuria, increased frequency of urination, increased micturition urgency, nocturia, bladder sensory loss, abdominal straining on micturition, urge incontinence, and stress incontinence.[44,45] Spontaneous recovery of bladder function is typically expected within 6 to 12 months after operation.[46,47] Vesicovaginal and ureterovaginal fistulas after radical hysterectomy have been reported in 0.9% to 2.7% of patients.[48,49]

Among the risk factors for urinary fistula development are stage of the disease, intraoperative bladder injury and hemorrhage, obesity, diabetes, extensive parametrial dissection (particularly after conization or prior radiotherapy), tumor larger than 4 cm, vaginal involvement, and postoperative infections. These factors may affect the rate of devascularization of the ureters, thus leading to a higher risk of fistula formation.

The most common presentation of urinary fistulas is continuous vaginal leakage of urine during the first to fourth postoperative weeks. To rule out a vesicovaginal fistula, one should perform a thorough speculum examination combined with a "tampon test" while infusing methylene blue solution into the bladder. Alternatively, one may perform a cystoscopy to directly assess bladder wall integrity. Early diagnosis of fistulas is essential to reduce delay in treatment and long-term urologic morbidity. Conservative treatment by placement of a bladder catheter for several weeks is one option, because spontaneous closure of a vesicovaginal fistula after continuous bladder drainage occurs in 15% to 20% of patients.[50] Factors contributing to successful conservative management are a short interval between diagnosis and drainage, limited duration of drainage, and small size of the fistula.

If conservative treatment fails, the patient should undergo surgical repair. The success rate of primary closure of the fistula is dependent on the location, size, and vascularization of the surrounding tissues. Both vaginal and abdominal approaches are possible, depending on the location of the fistula. In general, the first attempt at fistula closure is associated with the highest success rate. If primary closure fails, urinary diversion is most likely the only remaining option. In the diagnostic workup of a bladder fistula, the presence of a ureteric fistula should also be ruled out—for example, by using CT with intravenous pyelography. Although a rare event, a ureteric fistula should be treated at the earliest possible time, especially in patients with intraperitoneal leakage. Treatment of ureterovaginal fistulas mostly consists of surgical intervention. Conservative measures such as ureteric stenting and nephrostomy placement can be attempted, but often surgical repair by ureteric reimplantation combined with psoas hitch or Boari flap should be performed.[50]

Pelvic lymphocyst formation is another postoperative complication than may occur after lymphadenectomy. The reported incidence is 6% to 22%.[51,52] The frequency of lymphocyst may also vary based on the method used for detection of this complication. The incidence may be reported as low if the method of assessment is symptomatic manifestation. However, the frequency may be much higher if one uses more objective measures of evaluation such as imaging studies (pelvic ultrasound or CT scans). Most lymphocysts are asymptomatic and resolve spontaneously within several months after operation. Only a small percentage of patients (1.4%) require drainage. The standard procedure is ultrasound- or CT-guided percutaneous drainage, as recommended by Conte and colleagues.[53]

The incidence of urinary tract infections after radical hysterectomy ranges from 11% to 20%.[54,55] This complication may manifest with vague lower back pain, malaise, fever, and dysuria. When a urinary infection is suspected, one should consider a confirmatory evaluation by performing a urinalysis and urine cultures, particularly if the patient is febrile and has evidence of leukocytosis. The antibiotic regimen should be tailored according to the findings on the urine cultures. To avoid urinary tract infections, one should consider removing the urinary catheter at the earliest possible time.

The most common late complication of radical hysterectomy is lower limb lymphedema. The risk of developing this complication ranges from 5% to 20%.[41,56] Similar to the rate of lymphocyst formation, the incidence of lymphedema varies according to the method used for detection. Patients with lymphedema after a radical hysterectomy may have significant associated morbidity, including pain, impaired function of the lower extremity, and various psychological, social, and quality-of-life issues.[57] Lower extremity lymphedema (LEL) developed within 1 year of operation in 47 (60.3%) patients and occurred in 64 (82.1%) within 3 years of lymphadenectomy. The cumulative incidence of LEL at 1, 3, 5, and 10 years was 12.9%, 17.3%, 20.3%, and 25.4%, respectively. Kaplan-Meier analysis showed a significantly higher frequency of cumulative LEL in patients with a closed retroperitoneum than in those with an open retroperitoneum ($P < .0001$), in patients with removal of circumflex iliac nodes than in those with preservation of circumflex iliac nodes ($P < .0001$), in patients with cellulitis than in those without cellulitis ($P < .0001$), in patients with fewer than 70 lymph nodes removed than in those with 70 or more lymph nodes removed ($P = .020$), and in patients with lymph node metastasis than in those without lymph node metastasis.[58]

Once lymphedema has been diagnosed, compression stockings and physical therapy are commonly used, with a success rate up to 92%.[59] As a preventive measure, a recent study suggested that one should avoid pelvic lymph node dissection distal to the circumflex iliac vein, in the ganglionic group called CINDEIN (circumflex iliac nodes distal to external iliac nodes). The authors of these studies have proposed that the removal of these lymph nodes markedly increases the possibility of development of lymphedema, especially if adjuvant radiotherapy is used.[60,61] The standard implementation of sentinel node dissection techniques will hopefully reduce the incidence of LEL. Lymphovenous anastomosis has been proposed as a treatment option in patients in whom medical or conservative treatment has failed.[62] Mihara and colleagues published a retrospective analysis including 84 patients (162 limbs; 73 female and 11 male patients) with lower limb lymphedema who underwent multisite lymphaticovenous anastomosis. The average age was 60 years (range, 24 to 94 years); mean postoperative follow-up period was 18.3 months (range, 6 to 51 months). The postoperative change rate in limb circumference indicated that 67 limbs (48%) were classified as improved, 35 (27.3%) were classified as stable, and 32 (25%) were classified as worse. Postoperative interview revealed improvement in subjective symptoms in 67 limbs (61.5%), no change in 38 (35%), and exacerbation in four (3.7%). The postoperative mean occurrence of cellulitis decreased to 0.13 times per year compared with 0.89 preoperatively ($P = .00084$). The authors concluded that lymphaticovenous anastomosis is effective for lower limb lymphedema in point of limb circumference, subjective symptoms, and the frequency of cellulitis.[62]

Summary

ARH remains the preferred approach for most patients with early-stage cervical cancer, given the lack of minimally invasive technology in the developing world, where cervical cancer is most prevalent. It is important to ensure that all patients undergo appropriate preoperative evaluation and that patient selection is optimal in order to achieve the best possible outcomes. In performing the procedure, it is critical to ensure that adequate anatomic exposure is achieved and that all key steps of the procedure are appropriately followed. Given modern approaches in perioperative care, radical hysterectomy is currently associated with low morbidity and mortality. Further research will explore whether less aggressive procedures will be performed in the future and whether sentinel lymph node mapping alone will become the new standard of care.

Key Points

- Radical hysterectomy is generally recommended in the setting of stage IA2 to IIA1 cervical cancer.
- Routine preoperative workup includes a chest radiograph. Pelvic imaging with CT, MRI, or PET-CT is recommended only in the setting of high-risk factors for metastatic disease.
- Extent of the dissection is based on tumor size and stage.
- Indications for adjuvant therapy include positive pelvic nodes, vaginal or parametrial margins involved with disease, deep stromal invasion (>1/3), or ovarian metastasis.
- Approximately 15% to 20% of patients require postoperative chemotherapy and radiation after radical hysterectomy.
- Minimally invasive approaches are superior when compared with open approaches, because the former are associated with decreased postoperative pain, blood loss, transfusion rates, and length of stay.
- The most common intraoperative complication of open radical hysterectomy is blood loss.
- The most common postoperative complication after open radical hysterectomy is lower urinary tract dysfunction.
- The 5-year overall survival rate of radical hysterectomy without risk factors for adjuvant therapy exceeds 90%.
- Sentinel node mapping is becoming increasingly more popular and ultimately may replace complete lymphadenectomy.

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