Gynecologic Oncology
INTRODUCTION

Radical hysterectomy is distinguished from simple extrafascial hysterectomy by the dissection of the ureters from within the parametria and a wider resection of additional tissue surrounding the cervix, usually for an early-stage cancer of the cervix. The first radical abdominal hysterectomy for cervical cancer was performed in 1895 by John G. Clark at the Johns Hopkins Hospital under the direction of Howard A. Kelly. The vaginal approach to radical hysterectomy was described by Schauta in 1902. Ernst Wertheim contributed modifications to the procedure, and his published experience contributed greatly to the acceptance of radical hysterectomy as a viable treatment for women with early-stage cervical cancer. Later modifications were introduced by Okabayashi. Although recent attention has been directed toward implementation of a more anatomically distinct classification system of radical hysterectomy, including nerve-sparing variants, the Piver-Rutledge classification system, introduced in 1974, is still commonly referenced. In practice, there are three basic variations of radical hysterectomy. The Wertheim hysterectomy is the most commonly performed variant in the United States, has the broadest applicability, and is described in the following section. The two most common variations are the modified radical hysterectomy and the extended radical hysterectomy.

The most common indication for radical hysterectomy is the surgical treatment of early-stage (Stages IA2-IIA) cervical cancer. The efficacy of combined irradiation and low-dose chemotherapy for Stage IB2 disease has made this an uncommon indication for radical surgical treatment. Some centers also perform radical hysterectomy for Stage IIB cancer of the cervix, although this is rare in the United States. Radical hysterectomy may be indicated as completion surgery for patients with locally advanced cervical cancer with centrally persistent disease following definitive combined irradiation and low-dose chemotherapy. Radical hysterectomy is also a treatment option for patients with endometrial cancer extending to the cervix (clinical Stage II disease) and may be required as part of a larger cytoreductive surgical effort for patients with advanced ovarian cancer. The surgical principles of radical hysterectomy are also applicable to the operative management of a number of noncancerous gynecologic conditions including extensive endometriosis and uterine leiomyomata involving the cervix or lower uterine segment. Radical hysterectomy can be performed with or without pelvic lymphadenectomy or adnexectomy.

The typical route of approach to radical hysterectomy is abdominal, laparoscopic, or robotically assisted. Radical vaginal hysterectomy is uncommonly performed in the United States. This chapter addresses the abdominal approach, although the same basic principles apply whichever route is selected and are also applicable to conservative surgical approaches to early-stage cervical cancer for fertility preservation (radical trachelectomy).
PREOPERATIVE CONSIDERATIONS

In preparation for radical hysterectomy, all patients should undergo a comprehensive history and physical examination focusing on those areas that may indicate a reduced capacity to tolerate major surgery or disease-related characteristics (e.g., parametrial extension) that would contraindicate successful surgical resection. Routine laboratory testing should include a complete blood count, serum electrolytes, age-appropriate health screening studies, and electrocardiogram for women aged 50 years and older. Preoperative imaging of the pelvis and abdomen (computed tomography) is usually indicated to evaluate the extent of cervical pathology and associated extent of adenopathy for surgical planning purposes.

Preoperative mechanical bowel preparation (oral polyethylene glycol solution or sodium phosphate solution with or without bisacodyl) may facilitate pelvic exposure by making the small bowel and colon easier to manipulate but is not required. Prophylactic antibiotics (Cephazolin 1, Cefotetan 1 to 2 g, or Clindamycin 800 mg) should be administered 30 minutes prior to incision, and thromboembolic prophylaxis (e.g., pneumatic compression devices and subcutaneous heparin) should be initiated prior to surgery. The incision extended above the pelvic brim parallel to the abdomen, providing satisfactory exposure for radical hysterectomy. The common iliac artery is identified and traced distally to its bifurcation into the external iliac artery and internal iliac (hypogastric) artery, which courses deep along the lateral pelvic wall. The uterine arteries originate from the hypogastric artery within the cardinal ligament. The round ligament is identified and a ligature of 1-0 delayed absorbable suture placed as far laterally toward the pelvic sidewall as possible and held long for traction. A large hemoclips (or suture ligature) is placed medially (uterine side) to control back-bleeding, and the round ligament is divided. An incision is created in the anterior leaf of the broad ligament and is continued medially across the vesicouterine peritoneal reflection (or fold) at the junction of the lower uterine segment and cervix.

Either a low-transverse incision (Pfannenstiel, Maylard, Cherney) or low vertical midline incision will provide satisfactory exposure for radical hysterectomy, depending on patient body habitus. After abdominal entry and placement of a self-retaining retractor, adhesions are taken down, normal anatomy is restored, and the bowel is packed out of the surgical field.

The uterus is elevated out of the pelvis and manipulated by two large Kelly clamps placed across the broad ligament adjacent to the uterine fundus encompassing the round ligament, fallopian tube, and utero-ovarian ligament on each side. The broad ligament is incised cephalad to the round ligament, and the peritoneal incision extended above the pelvic brim parallel to the infundibulopelvic ligament. The common iliac artery is identified and traced distally to its bifurcation into the external iliac artery and internal iliac (hypogastric) artery, which courses deep along the lateral pelvic wall. The uterine arteries originate from the hypogastric artery within the cardinal ligament. The round ligament is identified and a ligature of 1-0 delayed absorbable suture placed as far laterally toward the pelvic sidewall as possible and held long for traction. A large hemoclips (or suture ligature) is placed medially (uterine side) to control back-bleeding, and the round ligament is divided. An incision is created in the anterior leaf of the broad ligament and is continued medially across the vesicouterine peritoneal reflection (or fold) at the junction of the lower uterine segment and cervix.

To perform radical hysterectomy safely and efficiently, six of the eight potential pelvic spaces should be developed early in the operation—the paired paravesical spaces, the paired pararectal spaces, the vesicovaginal space, and the rectovaginal space. The pararectal space is developed by carefully dissecting, with a finger or large Kelly clamp, between the hypogastric artery (laterally) and the medial leaf of the broad ligament peritoneum. The ureter is attached to the medial leaf of the broad ligament peritoneum and is most easily located at the pelvic brim in the region of the bifurcation of the common iliac artery. The ureter should be dissected from its adventitial sheath using a right angle clamp and placed within a vessel-loop for traction. The paravesical space is identified by placing upward traction on the round ligament ligature and the lateral surface of the bladder with a Babcock clamp. The obliterated umbilical artery will appear as a thick band of tissue running just lateral to the bladder, and it demarcates the medial border of the paravesical space. The paravesical space is developed with a finger or long Kelly clamp starting along the pelvic sidewall anterior to the cardinal ligament and dissecting anteriorly,

SURGICAL TECHNIQUE

Either general or regional anesthesia is acceptable. The patient should be positioned in low dorsal lithotomy position using Allen-type stirrups. The abdomen is prepped and a Foley catheter placed. Examination under anesthesia should pay particular attention to the size and topography of the cervix, uterus, proximal vagina, parametria, and uterosacral ligaments.

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medially, and inferiorly. Both the pararectal and paravesical spaces are developed down to the level of the pelvic floor (Figure 10.1).

Depending on clinical indications, adnexectomy and pelvic lymphadenectomy can be performed in conjunction with radical hysterectomy. These techniques are described in Chapters 2 and 12, respectively. If the adnexa are to be preserved, they are detached from the uterus and tucked into the upper abdomen. Otherwise, the infundibulopelvic ligaments are clamped, divided, secured with 1-0 delayed absorbable sutures, and the adnexa are tied to the Kelly clamps holding the uterus.

The pelvic sidewalls are inspected and palpated for evidence of metastatic nodal disease. The pelvic node dissection can be performed before or after the radical hysterectomy. Clinically suspicious lymph nodes should be excised and sent for frozen-section analysis. Some clinicians will abandon the radical hysterectomy if pelvic nodal metastases are documented, rationalizing that radiation therapy will be administered in any case and that completing the hysterectomy will add to the risk of morbidity. It is the author’s preference to complete the hysterectomy, provided the metastatic pelvic nodal disease is completely resectable; however, the radicality of the hysterectomy is scaled back to that of a modified radical procedure to reduce the risk of complications associated with combined radical surgery and adjuvant pelvic radiation therapy. The cardinal ligament, or “web” of tissue between the paravesical and pararectal spaces, is palpated to evaluate the local extension of cervical tumor and ensure the absence of disease in the paracervical tissues. Local tumor extension into the paracervical tissues is generally an indication to abandon radical hysterectomy.

The posterior leaf of the broad ligament is placed on medial traction and the ureters are dissected from their attachments to the lateral side of the uterosacral ligaments using a right angle clamp to gently develop the correct plane outside the adventitial sheath. The ureter is completely mobilized from the medial leaf of the broad ligament peritoneum from the level of the pelvic brim down to its entrance into the parametrial tunnel of Wertheim (cardinal ligament). Early mobilization of the bladder will facilitate ureteral dissection through the cardinal and vesicouterine ligaments. The bladder is grasped at the edge of the vesicouterine peritoneal incision and placed on ventral and caudal traction. Working in the midline, the electrosurgical unit is used to develop the vesicocervical space. At the level of the anterior vesicocervical junction, the bladder is attached to the cervix by the vesicocervical ligament, which separates the vesicocervical space from the more caudal vesicovaginal space. The electrosurgical unit is used to divide the vesicocervical ligament and mobilize the bladder off of the proximal vagina. As the bladder is mobilized caudally, the bladder pillars are defined at the anterolateral aspects of the cervix, appearing as a crescent-shaped complex of muscle fibers and fibrovascular connective tissue. The proximal component of the bladder pillar—the vesicouterine ligament—transmits the ureter from the parametrial tunnel of Wertheim to the bladder. The bladder is mobilized to expose the proximal 3 to 4 cm of vagina (Figure 10.2).
The uterine artery is identified by tracing the hypogastric artery distally or by locating the obliterated umbilical artery and tracing it proximally. A right angle clamp is used to skeletonize the lateral aspect of the uterine artery, which is then doubly ligated with 1-0 delayed absorbable sutures or clipped and divided at its origin from the hypogastric artery (Figure 10.3). The medial suture is left long and used to apply upward traction on the uterine artery as it is dissected from the underlying cardinal ligament and mobilized over the ureter. The ureter is sharply dissected from its attachments within the parametrial tunnel and mobilized laterally, using the vessel-loop for traction. The uterine vein follows a more unpredictable course, and may run above or below the ureter. It is ligated separately and divided as far laterally as possible.

The ureteral tunnel is developed within the vesicouterine ligament (bladder pillars) by introducing a right angle clamp along the superior and medial border of the ureter and gently spreading the tips of the clamp several times (Figure 10.4). The ureter should be maintained on gentle backward traction to facilitate dissecting in the correct plane outside the adventitial sheath. The vesicouterine ligament is then divided between fine-tipped clamps (Tonsil or right angle), and the anterior and posterior “leaves” are ligated with 2-0 or 3-0 delayed absorbable sutures and divided. The ureter is completely released from its attachments to the posterior leaf, rolled laterally, and dissected to the ureterovesical junction, leaving both anterior and posterior components of the vesicouterine ligament attached to the hysterectomy specimen.

Once the ureters have been completely mobilized from the pelvic brim to the bladder, attention is directed toward the posterior pelvis and cardinal ligament. The pelvic wall peritoneum of the medial leaf of the broad ligament is incised down to the base of the uterosacral ligament at the level of the rectum. The rectovaginal space is entered by placing the rectosigmoid colon on dorsal traction and incising the peritoneal Douglas cul-de-sac between the uterosacral ligaments. A combination of sharp and blunt dissection is used to develop the correct plane within the thin areolar tissue between the anterior rectal wall and posterior wall of the vagina (Figure 10.5). The rectum should be mobilized caudally for a distance of 3 to 4 cm. The uterosacral ligaments are divided between clamps (or using the electrosurgical unit or a vessel sealer-cutting device) close to the rectum, with the line of resection directed toward a point 3 cm below the cervicovaginal junction on the posterior vaginal wall.

The proximal rectal pillar, which is a continuation of the uterosacral ligament, and the anterior portion of the cardinal ligament are clamped as a unit and divided at the level of the pelvic sidewall (Figure 10.6). In this way, the posterior portion of the cardinal ligament and the associated autonomic nerves to the bladder and rectum are preserved. It may be necessary to take these structures in a series of successive bites, rather
than a single unit, if the resulting tissue pedicle is larger than 2 cm. A clamp is placed across the paravaginal tissue (paracolpos) such that the heel is juxtaposed to the pelvic wall and the tip of the clamp approximates the lateral vaginal wall 2 to 3 cm below the cervicovaginal junction or lowermost extent of palpable tumor (Figure 10.7). An anterior colpotomy is created using the electrosurgical unit or scissors. An “empty” spongystick introduced transvaginally can assist in selecting the appropriate site for colpotomy to ensure a 2- to 3-cm margin of resection. The proximal vagina is circumferentially resected using a series of bites with a heavy clamp (e.g., curved Heaney), each pedicle being sequentially divided and secured with a Heaney tranfixion stitch of 1-0 delayed absorbable suture and held long for traction (Figure 10.8). The final two bites incorporate the posterior-lateral vaginal wall and meet in the midline, and the specimen is removed. The vaginal cuff is closed with a series of figure-of-eight stitches of 1-0 delayed absorbable sutures.

If pelvic lymphadenectomy was not done prior to the radical hysterectomy, it is completed at this time. If the adnexa have been preserved and there is a low likelihood of adjuvant pelvic radiation, the
FIGURE 10.5 Radical abdominal hysterectomy: Posterior dissection showing uterosacral ligament and rectovaginal space.

FIGURE 10.6 Radical abdominal hysterectomy: Resection of the rectal pillar and anterior portion of cardinal ligament as a unit.
CHAPTER 10 Radical Abdominal Hysterectomy

Radical Abdominal Hysterectomy

Paravaginal tissue
Rectal pillar and anterior cardinal ligament

FIGURE 10.7 Radical abdominal hysterectomy: Resection of paravaginal tissue (paracolpos).

utero-ovarian ligament/fallopian tube complex pedicle is suspended to the round ligament stump as described in Chapter 2. If adjuvant pelvic radiation is anticipated, the adnexa are transposed out of the pelvis by widely mobilizing the infundibulopelvic ligament pedicles and suturing the utero-ovarian ligament/fallopian tube pedicles into the right and left paracolic gutters by tunneling beneath the cecum and ascending colon (on the right) and the sigmoid/descending colon (on the left).

The pelvis is irrigated, and all dissection areas are inspected to ensure hemostasis. The course and safety of the ureters should be verified. If there is any concern over a possible ureteral or bladder injury, cystoscopic examination with intravenous methylene blue or indigo carmine should be performed to assess the integrity of the urinary tract. Routine closed suction drainage of the pelvis is unnecessary but may be utilized at the discretion of the surgeon.

Radical hysterectomy variations

The modified radical hysterectomy is a scaled-back version of the Wertheim procedure, achieving a wider margin of resection than a simple extrafascial hysterectomy but with reduced morbidity. In this variation: 1) the uterine vessels are divided at the point where they cross the ureter within the cardinal ligament instead of at the pelvic wall, 2) the ureters are not completely extracted from the vesicouterine ligament, rather only the anterior leaf is resected with the hysterectomy specimen, 3) the cardinal ligaments/uterosacral ligaments are divided midway between the pelvic wall/rectum and uterus, and 4) only the upper 1 to 2 cm of vagina is removed.

The extended radical hysterectomy (Meigs/Oka-bayashi procedure) is indicated when a wider margin of resection is desired (e.g., large cervical lesion) and differs from the Wertheim procedure in the
following ways: 1) the cardinal ligament (both anterior and posterior components) is completely transected at the pelvic wall, independent of the rectal pillars, down to the pelvic floor, 2) the uterosacral ligaments and rectal pillars are divided at the level of the rectum, and 3) the upper one-third to one-half of the vagina is removed. Some clinicians also include the anterior division of the hypogastric artery in the scope of resection. The extended radical hysterectomy has a higher incidence of bladder, rectal, and sexual dysfunction compared to the Wertheim operation. Prolonged (2 to 3 weeks) bladder drainage is the norm.

POSTOPERATIVE CONSIDERATIONS

Postoperative care following radical abdominal hysterectomy is similar to that for any other major abdominal surgery. Estimated blood loss associated with radical abdominal hysterectomy averages between 800 and 1,500 cc, and approximately 50% of patients require intraoperative or postoperative transfusion. Diet can usually be advanced rapidly according to patient tolerance and clinical examination. Thromboembolic prophylaxis is continued until discharge or for a period of 4 to 6 weeks if the patient is at especially high risk for deep vein thrombosis. An indwelling Foley catheter is maintained 3 to 7 days postoperatively, depending on the radicality of resection and timing of hospital discharge. Bladder function is evaluated with a voiding trial by ensuring the bladder is completely emptied and back-filling it with 300 cc of saline solution through the Foley catheter. The catheter is removed and the patient is asked to void. If the residual volume is less than 75 cc (i.e., voided volume ≥225 cc), the catheter is not reinserted and the patient is instructed on timed voiding (every 3 to 4 hours) for the next several weeks. A failed voiding trial calls for reinsertion of the Foley catheter and re-examination in 4 to 7 days or instruction in intermittent self-catheterization. Criteria for discharge...
include: afebrile without evidence of uncontrolled infection, tolerating a normal diet without nausea or vomiting, satisfactory bowel function, and evidence of appropriate wound healing. Postoperative activity should be individualized; however, vaginal intercourse should be restricted for 8 weeks and a pelvic examination should be performed to confirm the integrity of the vaginal cuff.

**Operative Note**

**PROCEDURE: RADICAL ABDOMINAL HYSSTERECTOMY**

The uterus was grasped and elevated and the round ligaments were suture ligated and divided laterally on the pelvic wall. The pelvic peritoneal sidewalls were incised parallel to the external and common iliac vessels, and the pararectal and paravesical spaces were developed down to the pelvic floor. The ureters were placed within vessel-loops for traction and dissected from the pelvic brim down to the tunnel of Wertheim. Pelvic lymphadenectomy was performed (described in Chapter 12). The infundibulopelvic ligaments were isolated, doubly clamped, divided, and ligated with 1-0 delayed absorbable suture or the utero-ovarian ligament/fallopian tube complexes were clamped, divided, and ligated with 1-0 delayed absorbable suture and the adnexa tucked above the pelvic brim out of the field of dissection.

The vesicouterine peritoneal reflection was incised and the bladder reflected off of the anterior lower uterine segment, cervix, and proximal 3 to 4 cm of vagina. The uterine artery was dissected to its origin at the hypogastric artery, at which point it was doubly ligated with 1-0 delayed absorbable sutures and divided. The uterine vein was divided in a similar fashion. The uterine vascular pedicles were then reflected ventrally and medially and the ureter dissected along the tunnel of Wertheim and extricated from cardinal ligament. The ureteral tunnel was further developed within the vesicouterine ligament. The anterior and posterior leaves of the vesicouterine ligament were divided between clamps and ligated with 3-0 delayed absorbable sutures. The ureter was completely mobilized from its attachments to the vesicouterine ligament and rolled laterally, leaving both anterior and posterior leaves of the vesicouterine ligament attached to the hysterectomy specimen. The same maneuvers were repeated on the contralateral side.

The Douglas cul-de-sac was incised, and the rectovaginal space was developed inferiorly for a distance of 4 cm. The uterosacral ligaments were clamped and divided anterior to the rectum, and the pedicles secured with 1-0 delayed absorbable sutures. The proximal rectal pillar and the anterior portion of the cardinal ligament were clamped as a unit and divided at the level of the pelvic sidewall and the pedicle secured with a 1-0 delayed absorbable suture ligature. The same maneuvers were repeated on the contralateral side. Curved Heaney clamps were placed across the paracolpos approximating the lateral vaginal wall 3 cm below the cervicovaginal junction. An anterior colpotomy was created 3 cm below the cervicovaginal junction using the electrosurgical unit over a spongestick introduced transvaginally. The proximal vagina was circumferentially resected using a series of bites with curved Heaney clamps, each pedicle being sequentially divided and secured with a Heaney transfixion stitch of 1-0 delayed absorbable suture and held long for traction. The final two bites incorporated the posterior-lateral vaginal wall and met in the midline, and the specimen was removed intact. The vaginal cuff was closed with a series of figure-of-eight stitches of 1-0 delayed absorbable sutures. The pelvis was irrigated and all dissection areas inspected and noted to be hemostatic.

**COMPLICATIONS**

- The overall incidence of intraoperative complications (excluding major blood loss) is approximately 7%, with the most common being major vessel injury (2% to 3%), bladder injury (1% to 2%), and ureteral injury (1%).

- The overall incidence of postoperative morbidity is approximately 20%, with the most common complications being infectious morbidity (wound, urinary tract), thromboembolic events, lymphocyst formation, bladder dysfunction, ureteral or bladder fistula, and ureteral stricture.

- Excessive resection of the proximal vagina should be avoided unless clearly indicated by clinical factors, as it is associated with a high incidence of sexual dysfunction.
Suggested Reading


