RADICAL ABDOMINAL HYSTERECTOMY

Nadeem R. Abu-Rustum, MD, and William J. Hoskins, MD

Radical abdominal hysterectomy was developed in the late nineteenth century for the treatment of cancer of the cervix uteri and upper vagina. The procedure was originally described in 1895 by Clark and Reis,[30, 39] but Wertheim is credited for the development and improvement of the basic technique of radical hysterectomy. Wertheim reported extensively on his early results with this procedure and was a pioneer in describing approaches to reducing problems with hemorrhage, urinary tract injury, fistula formation, and sepsis.[3] Over the past century, the procedure underwent several refinements in indications, patient selection, and surgical technique. Moreover, the advancements in anesthesiology, antibiotics, and preoperative and postoperative medical care have resulted in a significant reduction in morbidity and mortality from this procedure.

Several competitors to radical abdominal hysterectomy have emerged over the years. Radiotherapy, discovered around the time that radical hysterectomy was being developed, continues to be used for the treatment of patients with advanced-stage (International Federation of Gynecologic Oncology [FIGO] stages IIB–IV) and selected patients with early stage cervical cancer. Furthermore, radical vaginal hysterectomy (Schauta-Amreich) has seen a recent revival since its early description, mainly because of the advancements in laparoscopic pelvic and paraaortic lymphadenectomy, which would accompany the vaginal resection of malignancy. In addition, laparoscopic radical hysterectomy and fertility-sparing radical transvaginal trachelectomy (i.e., removing the cervix and preserving the corpus) with laparoscopic pelvic lymphadenectomy are among the newest techniques to compete with the classic radical abdominal hysterectomy for the treatment of early cervical cancer. Nevertheless, radical abdominal

From the Disease Management Teams and Gynecology Service, Department of Surgery, Memorial Sloan-Kettering Cancer Center, New York, New York

Table 1. INDICATIONS FOR RADICAL ABDOMINAL HYSTERECTOMY

Indication	Extent of Disease
Invasive cervical cancer	Stage IA1 with lymphvascular invasion Stage IA2 Stage IB1 Stage IB2 (selected) Stage IIA (selected)
Invasive vaginal cancer	Stage I–II (limited to upper third of vagina, usually involving posterior vaginal fornix)
Endometrial cancer	Clinical stage IIB (gross cervical invasion)
Persistent or recurrent cervical cancer after radiotherapy	Clinically limited to cervix or proximal vaginal fornix

hysterectomy and pelvic lymphadenectomy are the gold standard to which all new surgical procedures should be compared.

INDICATIONS

Table 1 lists the common indications for radical abdominal hysterectomy. The procedure remains mostly used for the primary treatment of stage I–IIA cervical cancer. Table 2 summarizes the currently applied clinical staging system for cervical cancer, developed by FIGO in 1995. Selected patients with primary untreated vaginal or endometrial cancer, and some patients with persistent or recurrent cervical cancer after radiotherapy also may be candidates for this procedure.

As a result of the overall reduction in perioperative morbidity and the

Table 2. 1995 INTERNATIONAL FEDERATION OF GYNECOLOGIC ONCOLOGY CLINICAL STAGING FOR CERVICAL CANCER

Stage	Tumor Extension
0	Carcinoma in situ
I	Confined to the cervix (disregard corpus extension)
IA1	Stromal invasion $\leq$ 3 mm (depth), and $\leq$ 7 mm (width)
IA2	3 mm $<$ stromal invasion $\leq$ 5 mm (depth), and $\leq$ 7 mm (width)
IB1	Clinical lesion size $\leq$ 4 cm, or preclinical lesion $>$ IA2
IB2	Clinical lesion size $>$ 4 cm
II	Tumor extends beyond the cervix but not extending to pelvic wall or lower third of vagina
IIA	Vaginal involvement limited to upper two thirds, no parametrial involvement
IIB	Parametrial involvement
III	Extension to pelvic wall or lower third of vagina or hydronephrosis related to tumor
IIIA	Vaginal invasion to lower third, no extension to pelvic wall
IIIB	Extension to pelvic wall or hydronephrosis related to tumor
IV	Bladder or rectal mucosal invasion or extension beyond the true pelvis
IVA	Mucosal invasion of the bladder or rectum
IVB	Distant metastasis

advancements in surgical techniques, some investigators have expanded the indications of radical hysterectomy and pelvic or paraaortic lymphadenectomy to patients with stage III cervical cancer after response to neoadjuvant chemotherapy.[7] Most patients with stage IIB–IVA cervical cancer, however, are treated with definitive platinum-based chemoradiation.

SURGICAL ASPECTS

Basic Technique

The technique for radical abdominal hysterectomy was refined over the decades to optimize tumor resection and reduce normal tissue injury. The technique used most often in the United States is the class 3 (Meigs') hysterectomy.[54] A radical hysterectomy requires the removal of the cervix and corpus in conjunction with the parametria, paracolpos, and the upper one fourth to one third of the vagina. For the primary treatment of cervical cancer, a radical hysterectomy is routinely accompanied by bilateral pelvic lymphadenectomy in all patients, and paraaortic lymph node sampling in selected patients (usually stage IB1–IIA). Table 3 compares the extent of tissue resection for different surgical approaches used to treat early stage cervical cancer.

After examination with the patient under general anesthesia, the abdomen is opened using a low transverse (Maylard, Cherney, Pfannenstiel) or a low vertical abdominal incision. The abdominal and pelvic peritoneum are carefully explored for any evidence of metastasis, which would result in abandoning the procedure. Pelvic washings are not usually obtained because the yield is low and the prognostic significance is undetermined.[21, 42] If a paraaortic lymph node sampling is performed, it usually is done at this stage of the procedure and sent for frozen-section analysis. Approximately 5% to 10% of patients with stage IB disease have paraaortic lymph node metastases.[11, 36] Unlike uterine and ovarian malignancies, periaortic lymph node metastases in the absence of pelvic lymph node metastases are uncommon in patients with cervical cancer.[11]

Metastasis to resectable or unresectable paraaortic lymph nodes is considered a contraindication to radical hysterectomy by many gynecologic oncologists. These patients are treated with extended-field radiotherapy with concomitant platinum-based chemotherapy. The benefit of a complete resection of grossly enlarged positive paraaortic lymph nodes when radiotherapy is planned is undetermined.[36]

The pelvic component of the procedure is started by opening the paravesical and pararectal spaces bilaterally to assess resectability and rule out a gross parametrial invasion. The bladder peritoneum and the posterior cul de sac peritoneum also may be opened to rule out gross extension of the cervical tumor in the anteroposterior plane. The pelvic lymphadenectomy can be performed before or after the radical hysterectomy. A pelvic lymphadenectomy requires the bilateral removal of all visible nodal tissue from the mid-portion of the common iliac artery to the deep circumflex iliac vein, with complete skeletonization of all blood vessels. Laterally, the resection extends from the mid-portion of the psoas muscle to the ureter medially. The hypogastric artery and vein are dissected, and the obturator lymph nodes anterior to and around the obturator nerve are removed. The pelvic and paraaortic lymph nodes are removed separately, and the parametrial lymph nodes commonly remain attached to the main specimen.

If unresectable pelvic lymph nodes are encountered, the upper extent of nodal involvement should be determined and the procedure abandoned. These

Table 3. COMPARISON OF EXTENT OF RESECTION FOR SURGICAL PROCEDURES TO TREAT EARLY STAGE CERVICAL CANCER

Tissue	Cervical Conization	Total Abdominal or Vaginal Hysterectomy	Modified Radical Hysterectomy	Radical Abdominal Hysterectomy	Radical Vaginal Trachelectomy	Radical Vaginal Hysterectomy
Cervix uteri	Partially removed	Completely removed	Completely removed	Completely removed	Majority removed	Completely removed
Corpus uteri	Preserved	Completely removed	Completely removed	Completely removed	Preserved	Completely removed
Ovaries and tubes	Preserved	Preserved	Preserved	Preserved	Preserved	Preserved
Parametria and paracolpos	Preserved	Preserved	Removed at level of ureter	Removed lateral to ureter	Partially removed	Removed at level of ureter
Uterine vessels	Preserved	Ligated at level of cervical internal os	Ligated at level of ureter	Ligated at origin from hypogastric vessels	Preserved	Ligated at level of ureter
Uterosacral ligaments	Preserved	Ligated at uterus	Ligated midway to sacral attachment	Ligated near sacral attachment	Partially removed	Partially removed
Vaginal cuff	Preserved	None removed	1–2 cm removed	≥ 2 cm removed	1–2 cm removed	≥ 2 cm removed

patients are treated with definitive platinum-based chemoradiation. The intraoperative management of resectable positive pelvic lymph nodes is more controversial. In some patients, a paraaortic lymph node sampling is performed (to determine the extent of metastasis), the hysterectomy is abandoned, and the patient is treated with definitive platinum-based chemoradiation tailored to the extent of nodal involvement. In others, a pelvic and paraaortic lymphadenectomy and radical hysterectomy are completed, and the patient is offered adjuvant postoperative therapy. Platinum-based adjuvant chemoradiation is associated with improved survival over adjuvant radiation alone in these patients.[52] Whether debulking of metastatic disease in pelvic lymph nodes is beneficial is unclear; however, some investigators have described improved survival when bulky pelvic lymph nodes were resected before radiotherapy.[19] Furthermore, other investigators have questioned the strategy of aborting the procedure when a pelvic lymph node metastasis is found on frozen-section analysis because complete removal of pelvic lymph nodes, in combination with radical hysterectomy and postoperative radiotherapy, is associated with improved disease-free survival and lower recurrence rates.[32]

Landmarks for radical abdominal hysterectomy include:

1. Removal of the uterus, cervix, and upper one fourth to one third of the vagina with the contiguous parametrial and paravaginal tissue
2. Transecting the uterine artery at its origin from the hypogastric artery
3. Unroofing of the ureter from its entry into the broad ligament to its intramural portion in the bladder, with lateral retraction from its attachments to the cardinal ligament to allow for resection of the parametria
4. Resection of the proximal uterosacral ligament near its sacral attachment (Figs. 1 and 2)

The Okabayashi radical abdominal procedure for cervical cancer, first described in 1921, is an extensive abdominal hysterectomy and pelvic lymphadenectomy with the following landmarks[45, 64]:

1. An extensive resection of the cardinal ligament
2. Extensive and complete resection of the vesicouterine ligament
3. Complete pelvic lymphadenectomy
4. The posterior procedure (resection of the cardinal and uterosacral ligaments) completed before the anterior procedure.

A radical abdominal hysterectomy does not necessitate removal of the tubes and ovaries, particularly because of the low prevalence of metastasis to the ovary from a stage IB cervical cancer (0.5% in squamous cancers and 1.7% in adenocarcinoma; $P = 0.19$).[62] The adnexa are usually removed in perimenopausal and postmenopausal patients, if grossly abnormal, or for ovarian cancer prophylaxis in the appropriate candidates. Lateral ovarian transposition of the retained adnexa at the time of hysterectomy is occasionally used. The potential benefit is preservation of ovarian function after adjuvant radiotherapy. Placement of the ovaries is crucial, however, with all patients developing menopause if the ovaries are placed below the iliac crest.[14] The development of symptomatic ovarian cysts is common in these patients regardless of the use of adjuvant radiotherapy; furthermore, nearly 25% of patients experience early loss of hormonal function or require subsequent oophorectomy.[14, 40]

Modified Radical Hysterectomy

The class 2 extended hysterectomy is intended to remove more paracervical and upper vaginal tissue than a simple hysterectomy while still preserving most

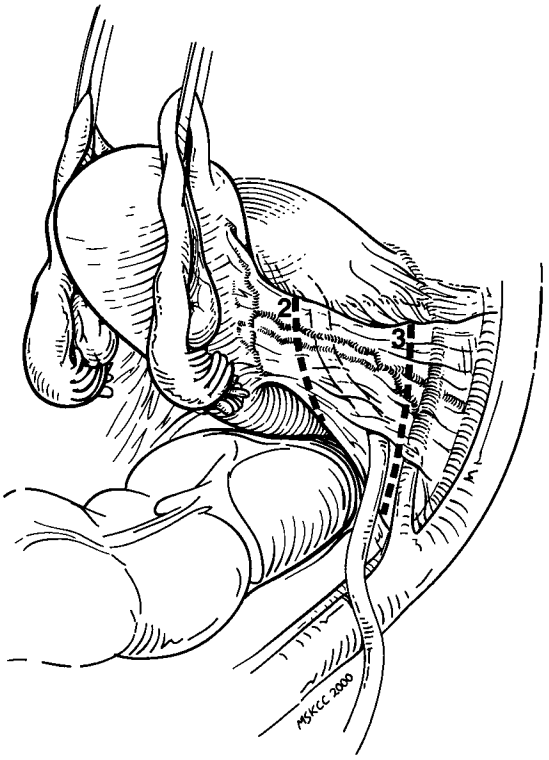

Figure 1. The point of transsection of the cardinal ligaments in a Class II (2) and III (3) radical hysterectomy.

of the blood supply to the distal ureter and bladder. Landmarks of this moderately extended hysterectomy include[54]:

1. Ligation of the uterine artery just medial to the ureter
2. Division of the uterosacral ligaments midway between the uterus and their sacral attachment
3. Resection of the medial half of the cardinal ligament and the upper one third of the vagina

This procedure traditionally is reported to be suitable for microinvasive cancers and small postirradiation recurrences limited to the cervix.[18] More recently, modified radical hysterectomy was reported to be effective for treating squamous cervical cancers less than or equal to 2 cm in diameter,[37] or exophytic squamous carcinomas less than 2 cm in diameter and invading less than 10 mm, as diagnosed by conization, with reduced postoperative voiding difficulty and constipation.[65]

Surgical and Perioperative Advancements

With increasing use and experience with radical abdominal hysterectomy, many perioperative and intraoperative modifications have been described. Anti-

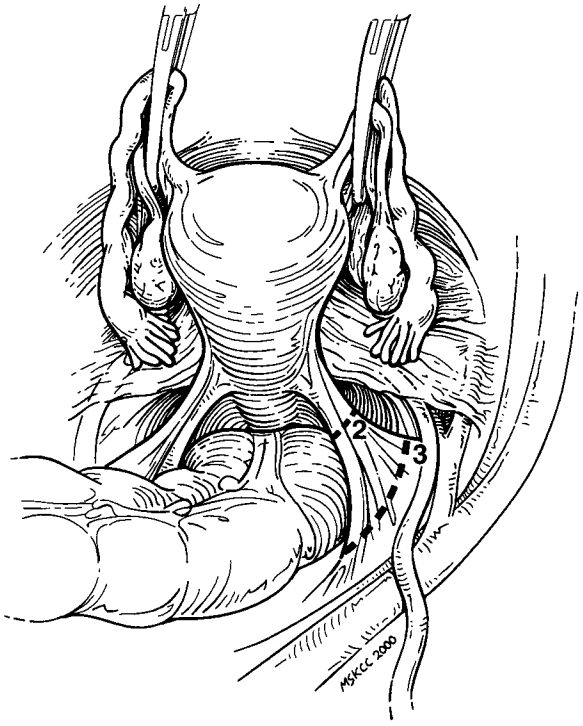

Figure 2. The point of transsection of the uterosacral ligaments in a Class II (2) and III (3) radical hysterectomy.

biotic prophylaxis with single-dose doxycycline, or multiple doses of cefoxitin, has been associated with decreased febrile morbidity and decreased rates of severe infections in women undergoing radical abdominal hysterectomy[56, 61]; moreover, short-term (i.e., 3 doses) and long-term (i.e., 12 doses) intravenous cefoxitin prophylaxis is equally effective for the prevention of postoperative surgical site related infections.[61] Several other factors, such as operating time, patient weight, blood loss, and blood replacement, may be related to the prevalence of febrile morbidity and should be examined carefully in efforts to combat infectious morbidity after radical hysterectomy.[38] Single-dose or short-term intravenous antibiotic prophylaxis is an acceptable alternative in the management of women undergoing radical abdominal hysterectomy.

The choice of abdominal incision also has contributed significantly to a shorter postoperative recovery and a lower perioperative complication rate. Radical abdominal hysterectomy and pelvic lymphadenectomy can be safely and adequately performed through a transverse lower abdominal incision (Maylard, Cherney, or Pfannenstiel) in appropriate candidates. In selected patients (i.e., younger and weight appropriate), the Pfannenstiel incision was associated with a shorter surgical time, blood loss, transfusion rate, and hospital stay compared with a Maylard or vertical incision.[46] Advantages of the Maylard transverse incision compared with a vertical incision include fewer wound complications, reduced pulmonary complications, and better tolerance to early feeding.[26]

Blood loss during radical hysterectomy and pelvic lymphadenectomy also decreased with increasing experience and awareness of blood-borne infectious diseases. The estimated mean blood loss decreased between the early 1980s and the early 1990s (1598 vs 756 mL) with a marked decrease in perioperative blood transfusion rates, without immediate adverse effects on postoperative recovery.[10] Furthermore, the use of intraoperative autologous blood transfusion seems to be safe and effective without compromising rates and patterns of recurrence.[40]

To improve the therapeutic index of radical abdominal hysterectomy, several investigators have developed new modifications to accomplish the procedure. Improvement in the radicality of lateral parametrial resection using surgical hemoclips instead of clamps (i.e., the modified Magara technique) resulted in a significantly greater parametrial resection than with the Meigs technique (52 vs 34 mm; $P < 0.05$). The modification was also safe and feasible in nearly 90% of patients.[9] Further developments accompanied the availability of newer surgical instruments. Using the endoscopic disposable stapler to transect the cardinal and uterosacral ligaments has resulted in a significant reduction in surgical time and median blood loss, without adversely affecting febrile morbidity, surgical complications, length of hospital stay, or tumor recurrence rate.[12, 49] Furthermore, novel surgical techniques with intraoperative electrical stimulation to identify and preserve the vesical nerve branches also have been reported to reduce bladder dysfunction.[33] The liposuction-assisted nerve sparing radical hysterectomy, which results in removal of perispinous adipose tissue by liposuction, extending the parametrial resection margins without impairing pelvic autonomic nerve function or increasing the complication rate, has also been described.[28] The "retroperitoneal radical hysterectomy," a surgical technique that requires small, oblique skin incisions superior to the inguinal ligaments, exposing the retroperitoneum to allow transection of the round ligament, uterine artery, ovarian vessels, and cardinal ligament, followed by a modified Schauta technique (i.e., radical transvaginal hysterectomy) was associated with shorter surgical time and hospital stay[17]; however, this approach has been superseded by the laparoscopic radical hysterectomy or laparoscopically assisted radical vaginal hysterectomy and pelvic lymphadenectomy (i.e., modified Schauta-Stoeckel).[25, 47, 58]

Management of the ureters, peritoneum, and lymphatics also has prompted several investigations. In 1993, Averette et al[2] reported a 25-year experience with the Miami modification to radical hysterectomy for stage IB–IIA cervical cancer, which included vaginal reconstruction and closure using bladder and rectosigmoid serosa, retroperitoneal drainage through abdominal suction catheters, and suspension of the denuded ureters with the ipsilateral obliterated hypogastric artery. This modification was associated with a reduction in urinary fistula rates and lengthening in the vagina. The routine use of pelvic drains also was investigated recently. Retroperitoneal pelvic suction drains led to fewer ureteral and bladder complications, and was quicker to perform, than peritoneal sheathing of the ureters (Ohkawa technique).[11a] The single vaginal closed-suction drain resulted in a febrile morbidity and lymphocyst formation rate similar to that of two pelvic sidewall and vaginal drains.[6] Furthermore, the routine use of retroperitoneal pelvic suction drains recently has been challenged by investigators in England and the United States who reported no increase in postoperative pelvic infection, fistula, or lymphocyst formation in women who did not have drains inserted.[35, 51] Pelvic drains remain necessary in some patients to assess postoperative blood loss.

Currently, nonclosure of the peritoneum typically is performed. Nonclosure of the peritoneum with vaginal cuff closure and placement of pelvic drains has

been compared in a randomized trial to a standard closure of the pelvic and parietal peritoneum and placement of a T-shaped suction pelvic drain, with no associated increased incidence of infections or adhesion-related complications.[23] In addition, the routine use of the omental J-flap (omentopexy) has been described as an effective means of minimizing urinary tract fistulas and pelvic infections, and some investigators advocate its routine placement at the conclusion of radical abdominal hysterectomy.[50]

A more aggressive approach toward quicker postoperative recovery and discharge from the hospital generally is accepted nowadays. The most notable trend reported has been a marked decrease in length of hospital stay from 12.8 to 3.5 days. Contributing factors include use of the transverse lower abdominal incision, placement of a suprapubic Foley catheter, discontinuation of pelvic drains, early oral feeding, admission to the hospital on the day of surgery, and initiation of critical care pathways.[26] Early oral alimentation starting on postoperative day 1 and abandoning of routine gastric drainage tubes were well tolerated and resulted in a higher protein and energy intake.[27] Early oral feeding and bowel stimulation with milk of magnesia and biscolic suppositories also were associated with a 50% reduction in hospital stay (8 vs 4 days; $P = 0.001$) with no noticeable complications.[22]

OUTCOME

It has been accepted for many decades that radical hysterectomy and pelvic lymphadenectomy or radiotherapy are equally effective in the treatment of early cervical cancer. In 1975, Newton reported no significant difference in 10-year survival rates of 75% versus 65% for stage I cervical cancer treated with radical hysterectomy or radiotherapy, respectively.[44] More recently, 5-year survival rates of 92% with surgery and 86% with radiotherapy ($P = 0.098$) have been reported in women with stage IB squamous cancers.[29] These findings also have been affirmed in a randomized trial of surgery versus radiation in stage IB–IIA patients (5-year overall survival rates, 83% and 74%, respectively).[34]

Several risk factors for increased recurrence rates and decreased survival have been identified. Nodal metastasis, tumor size, depth of cervical invasion, lymphovascular invasion, histologic cell type, and grade have been reported as prognostic risk factors for recurrence in stage IB–IIA cervical cancer.[30] Adjuvant radiotherapy has traditionally been prescribed after radical hysterectomy for women with pathologic risk factors. Decreased local tumor recurrence is usually reported; a survival benefit, however, has not been universally accepted.[43] The role of adjuvant cisplatin-based chemotherapy also was compared in randomized trials to chemotherapy followed by radiotherapy in a sequential manner. Women with high-risk factors following radical hysterectomy and pelvic lymphadenectomy (positive lymph nodes, positive parametria, positive margins, tumor size of more than 4 cm, stromal invasion of more than 75%, nonsquamous histology), were investigated.[16, 63] The adjuvant sequential chemotherapy–radiotherapy group had no significant disease-free survival, overall survival, or patterns of recurrences compared with the group treated with adjuvant chemotherapy alone. These data created more uncertainty about the variety and role of adjuvant therapy in high-risk patients.

It is generally accepted that lymph node metastasis, parametrial metastasis, or positive surgical margins are poor prognostic factors that require adjuvant therapy. Platinum-based concomitant chemoradiation is the preferred adjuvant

therapy for these risk factors, with improved projected progression-free 4-year survival rates compared with radiation alone (80% vs 63%).[52]

Other pathologic risk factors identified in the cervix of patients who underwent radical hysterectomy and pelvic lymphadenectomy and were found to have negative lymph nodes, negative parametria, and negative surgical margins include clinical tumor size, stromal invasion, and lymphovascular space invasion.[59] Adjuvant pelvic external radiotherapy, compared with no further therapy, recently was reported to improve local control (2-year recurrence-free rate, 88% vs 79%), and possibly survival, in similar selected patients with these local tumor-related risk factors. This potential improvement came at a cost of 6% grade 3/4 adverse events compared with 2.1% in the no-radiation group.[59]

Neoadjuvant chemotherapy for bulky stage IB (> 4 cm), or locally advanced stage IB–III cervical cancers, followed by radical hysterectomy and pelvic lymphadenectomy (plus adjuvant radiotherapy in selected high-risk patients), has been advocated by some investigators.[8, 57] Neoadjuvant chemotherapy has been reported to improve survival in selected stage IB patients compared with radical hysterectomy and adjuvant radiotherapy.[57] The Gynecologic Oncology Group is conducting a randomized trial to address the role of neoadjuvant cisplatin plus vincristine chemotherapy in bulky stage IB (> 4 cm) cervical cancer after encouraging results with a pilot study.[20]

COMPLICATIONS

The complications of radical hysterectomy are well described in the gynecologic literature. Short-term and long-term bladder dysfunction remains a common side effect with bladder atony (catheter drainage > 2 weeks) reported in as many as 42% of patients.[1] Adjuvant pelvic radiotherapy is associated with more contracted and unstable bladders than surgery alone; in addition, prolonged catheterization (> 30 days) is associated with worse long-term postvoid residual and total bladder capacity.[4] The duration of postoperative bladder catheterization has decreased in recent years, with a median indwelling catheter duration of 6 days compared with 30 days in historical controls and no increase in complication rates.[15] Intermittent self-catheterization may be needed by the few patients with prolonged bladder dysfunction.

Ureterovaginal and vesicovaginal fistulas occur in approximately 2% to 4% of patients, and postoperative ureteral obstruction requiring surgical intervention occurs in 0.6% to 0.9% of cases.[1, 30, 55] Nearly one third of urinary tract fistulas heal spontaneously after surgery compared with none if adjuvant radiotherapy is delivered.[55] Early postoperative intravenous pyelography in the absence of intraoperative urinary tract injury or clinical symptoms suggestive of injury is not indicated; moreover, an abnormal early intravenous pyelogram is not predictive of subsequent urinary tract dysfunction.[13] The class 2 radical hysterectomy is associated with a lower fistula rate, surgical time, and postoperative hospital stay compared with the class 3 procedure.[53]

Acute and chronic rectal dysfunction, although less common than bladder dysfunction, may occur after radical hysterectomy. Altered manometric parameters, such as varied relaxation of the internal sphincter, increased distension needed to trigger relaxation, and decreased rectal sensation, are commonly abnormal after radical hysterectomy. Some patients report a decreased defecatory urge and difficulty with rectal evacuation and constipation. Dietary fiber modifications and rectal stimulation with suppositories over several weeks or months are effective for addressing bowel dysfunction following radical hysterectomy.[5, 24]

Small bowel obstruction occurs in 1.3% to 5.0% of patients[1, 41] and may increase as much as 20% if pelvic radiotherapy is used before or after the procedure.[41] Other described complications include vaginal cuff cellulitis/abscess (5.0%), wound infection (2.0%), pneumonia (2.0%), pulmonary embolism (1.3%), obturator nerve transection (0.6%), and peroneal nerve compression (0.6%).[1]

SUMMARY

Radical abdominal hysterectomy and pelvic lymphadenectomy remain the gold standard procedures for the treatment of early cervical cancer. Over the years, the establishment of formal gynecologic oncology training programs, general medical advancements, and new surgical techniques have resulted in a satisfactory tumor resection, with improved overall therapeutic index and reliable cure rates. The role of neoadjuvant and adjuvant therapy continues to be defined as the results from randomized trials emerge.

References

1. Artman LE, Hoskins WJ, Bibro MC, et al: Radical hysterectomy and pelvic lymphadenectomy for stage IB carcinoma of the cervix: 21 year experience. Gynecol Oncol 28:8–13, 1987
2. Averette HE, Nguyen HN, Donato DM, et al: Radical hysterectomy for invasive cervical cancer: A 25-year prospective experience with the Miami technique. Cancer 71:1422–1437, 1993
3. Ballon SC: The Wertheim hysterectomy. Surg Gynecol Obstet 142:920–924, 1976
4. Bandy LC, Clarke-Pearson DL, Soper JT, et al: Long-term effects on bladder function following radical hysterectomy with and without postoperative radiation. Gynecol Oncol 26:160–168, 1987
5. Barnes W, Waggoner S, Delgado G, et al: Manometric characterization of rectal dysfunction following radical hysterectomy. Gynecol Oncol 42:116–119, 1991
6. Barton DP, Cavanagh D, Roberts WS, et al: Radical hysterectomy for treatment of cervical cancer: A prospective study of two methods of closed-suction drainage. Am J Obstet Gynecol 166:533–537, 1992
7. Benedetti-Panici P, Maneschi F, Cutillo G, et al: Modified type IV-V radical hysterectomy with systematic pelvic and aortic lymphadenectomy in the treatment of patients with stage III cervical carcinoma: Feasibility, technique, and clinical results. Cancer 78:2359–2365, 1996
8. Benedetti-Panici P, Greggi S, Scambia G, et al: Long-term survival following neoadjuvant chemotherapy and radical surgery in locally advanced cervical cancer. Eur J Cancer 34:341–346, 1998
9. Benedetti-Panici P, Scambia G, Baiocchi G, et al: Radical hysterectomy: A randomized study comparing two techniques for resection of the cardinal ligament. Gynecol Oncol 50:226–231, 1993
10. Benjamin I, Barakat RR, Curtin JP, et al: Blood transfusion for radical hysterectomy before and after discovery of transfusion-related human immunodeficiency virus infection. Obstet Gynecol 84:974–978, 1994
11. Berman ML, Keys H, Creasman W, et al: Survival and patterns of recurrence in cervical cancer metatstatic to periaortic lymph nodes (a Gynecologic Oncology Group study). Gynecol Oncol 19:8–16, 1984

11a. Blythe JG, Hodel KA, Wahl TP: A comparison between peritoneal sheathing of the ureters (Ohkawa technique) and retroperitoneal pelvic suction drainage in the prevention of uretral damage during radical abdominal hysterectomy. Gynecol Oncol 30:222–227, 1988

12. Brewer CA, Chan J, Kurosaki T, et al: Radical hysterectomy with the endoscopic stapler. Gynecol Oncol 71:50–52, 1998
13. Buller RE, Tamir IL, DiSaia PJ, et al: Early evaluation of the urinary tract following radical hysterectomy: structure and function relationships. Obstet Gynecol 78:840–844, 1991
14. Chambers SK, Chambers JT, Kier R, et al: Sequelae of lateral ovarian transposition in irradiated cervical cancer patients. Int J Radiat Oncol Biol Phys 20:1305–1308, 1991
15. Chamberlain DH, Hopkins MP, Roberts JA, et al: The effects of early removal of indwelling urinary catheter after radical hysterectomy. Gynecol Oncol 43:98–102, 1991
16. Curtin JP, Hoskins WJ, Venkatraman ES, et al: Adjuvant chemotherapy versus chemotherapy plus pelvic irradiation for high-risk cervical cancer patients after radical hysterectomy and pelvic lymphadenectomy (RH-PLND): A randomized phase III trial. Gynecol Oncol 61:3–10, 1996
17. Delgado G, Potkul RK, Dolan JR: Retroperitoneal radical hysterectomy. Gynecol Oncol 56:191–194, 1995
18. DiSaia PJ: Surgical aspects of cervical carcinoma. Cancer 48:548–559, 1981
19. Downey GO, Potish RA, Adcock LL, et al: Pretreatment surgical staging in cervical carcinoma: Therapeutic efficacy of pelvic lymph node resection. Am J Obstet Gynecol 169:1055–1061, 1989
20. Eddy GL, Manetta A, Alvarez RD, et al: Neoadjuvant chemotherapy with vincristine and cisplatin followed by radical hysterectomy and pelvic lymphadenectomy for FIGO stage IB bulky cervical cancer: A gynecologic oncology group pilot study. Gynecol Oncol 57:412–416, 1995
21. Estape R, Angioli R, Wagman F, et al: Significance of intraperitoneal cytology in patients undergoing radical hysterectomy. Gynecol Oncol 68:169–171, 1998
22. Fanning J, Yu-Brekke S: Prospective trial of aggressive postoperative bowel stimulation following radical hysterectomy. Gynecol Oncol 73:412–414, 1999
23. Franchi M, Ghezzi F, Zanaboni F, et al: Nonclosure of peritoneum at radical abdominal hysterectomy and pelvic node dissection: A randomized study. Obstet Gynecol 90(4 Pt 1):622–627, 1997
24. Griffenberg L, Morris M, Atkinson N, et al: The effect of dietary fiber on bowel function following radical hysterectomy: A randomized trial. Gynecol Oncol 66:417–424, 1997
25. Hatch KD, Hallum AV III, Nour M: New surgical approaches to treatment of cervical cancer. J Natl Cancer Inst Monogr 21:71–75, 1996
26. Helmkamp BF, Krebs HB, Corbett SL, et al: Radical hysterectomy: Current management guidelines. Am J Obstet Gynecol 177:372–374, 1997
27. Hessov I, Rylev LK, Sondergaard K: Improved early alimentation after radical hysterectomy without the traditional use of stomach tubes. Acta Obstet Gynecol Scand 67:225–228, 1988
28. Hockel M, Konerding MA, Heussel CP: Liposuction-assisted nerve-sparing extended radical hysterectomy: oncologic rationale, surgical anatomy, and feasibility study. Am J Obstet Gynecol 178:971–976, 1998
29. Hopkins MP, Morley GW: Radical hysterectomy versus radiation therapy for stage IB squamous cell cancer of the cervix. Cancer 68:272–277, 1991
30. Hoskins WJ, Ford JH, Lutz MH, et al: Radical hysterectomy and pelvic lymphadenectomy for the management of early invasive cancer of the cervix. Gynecol Oncol 4:278–290, 1976
31. Hoskins WJ. Prognostic factors for risk of recurrences in stages Ib and IIa cervical cancer. Bailliere's Clinical Obstetrics and Gynaecology 2:817–828, 1988
32. Kenter GG, Hellebrekers BW, Zwinderman KH, et al: The case for completing the lymphadenectomy when positive lymph nodes are found during radical hysterectomy for cervical carcinoma. Acta Obstet Gynecol Scand 79:72–76, 2000
33. Kuwabara Y, Suzuki M, Hashimoto M, et al: New method to prevent bladder dysfunction after radical hysterectomy for uterine cervical cancer. J Obstet Gynaecol Res 26:1–8, 2000
34. Landoni F, Maneo A, Colombo A, et al: Randomized study of radical surgery versus radiotherapy for stage Ib–IIa cervical cancer. Lancet 350:535–540, 1997

35. Lopes AD, Hall JR, Monaghan JM: Drainage following radical hysterectomy and pelvic lymphadenectomy: Dogma or need? Obstet Gynecol 86:960–963, 1995
36. Lovecchio JL, Averette HE, Donato D, et al: 5-year survival of patients with periaortic nodal metastasis in clinical stage IB and IIA cervical cancer. Gynecol Oncol 34:43–45, 1989
37. Magrina JF, Goodrich MA, Linder, TK, et al: Modified radical hysterectomy in the treatment of early squamous cervical cancer. Gynecol Oncol 72:183–186, 1999
38. Marsden DE, Cavanagh D, Wisniewski BJ, et al: Factors affecting the incidence of infectious morbidity after radical hysterectomy. Am J Obstet Gynecol 152:817–821, 1985
39. Mikuta JJ: A history of the centennial of the first radical hysterectomy and its developer, Dr. John Clark. J Pelvic Surg 1:3–7, 1995
40. Mirhashemi R, Averette HE, Deepika K, et al: The impact of intraoperative autologous blood transfusion during type III radical hysterectomy for early-stage cervical cancer. Am J Obstet Gynecol 181:1310–1315, 1999
41. Montz FJ, Holschneider CH, Solh S, et al: Small bowel obstruction following radical hysterectomy: risk factors, incidence, and operative findings. Gynecol Oncol 53:114–120, 1994
42. Morris PC, Haugen J, Anderson B, et al: The significance of peritoneal cytology in stage IB cervical cancer. Obstet Gynecol 80:196–198, 1992
43. Morrow CP: Panel report: Is pelvic radiation beneficial in the post operative management of stage IB squamous cell carcinoma of the cervix with pelvic node metastasis treated by radical hysterectomy and pelvic lymphadenectomy? Gynecol Oncol 10:105–110, 1980
44. Newton M: Radical hysterectomy or radiotherapy for stage I cervical cancer: A prospective comparison with 5 and 10 years follow-up. Am J Obstet Gynecol 123:535–542, 1975
45. Okabayashi H: Radical abdominal hysterectomy for cancer of the cervix uteri. Surg Gynecol Obstet 33:335–341, 1921
46. Orr JW, Orr PJ, Bolen DD, et al: Radical hysterectomy: Does the type of incision matter? Am J Obstet Gynecol 173:399–406, 1995
47. Ostrzenski A: A new laparoscopic abdominal radical hysterectomy: A pilot phase trial. Eur J Surg Oncol 22:602–606, 1996
48. Parker M, Bosscher J, Barnhill D, et al: Ovarian management during radical hysterectomy in premenopausal patients. Obstet Gynecol 82:187–190, 1993
49. Patsner B: Radical abdominal hysterectomy using the ENDO-GIA stapler: report of 150 cases and literature review. Eur J Gynaecol Oncol 19:215–219, 1998
50. Patsner B, Hackett TE: Use of the omental J-flap for prevention of postoperative complications following radical abdominal hysterectomy: Report of 140 cases and literature review. Gynecol Oncol 65:405–407, 1997
51. Patsner B: Closed-suction drainage versus no drainage following radical abdominal hysterectomy with pelvic lymphadenectomy for Stage IB cervical cancer. Gynecol Oncol 57:232–234, 1995
52. Peters WA, Liu PY, Barrett RJ, et al: Concurrent chemotherapy and pelvic radiation therapy compared with pelvic radiation therapy alone as adjuvant therapy after radical surgery in high-risk early-stage cancer of the cervix. J Clin Oncol 18:1606–1613, 2000
53. Photopulos GJ, Zwaag RV: Class II radical hysterectomy shows less morbidity and good treatment efficacy compared to Class III. Gynecol Oncol 40:21–24, 1991
54. Piver SM, Rutledge F, Smith JP: Five classes of extended hysterectomy for women with cervical cancer. Obstet Gynecol 44:265–272, 1974
55. Ralph G, Tamussino K, Lichtenegger W: Urological complications after radical hysterectomy with or without radiotherapy for cervical cancer. Arch Gynecol Obstet 248:61–65, 1990
56. Rosenshein NB, Ruth JC, Villar J, et al: A prospective randomized study of doxycycline as a prophylactic antibiotic in patients undergoing radical hysterectomy. Gynecol Oncol 15:201–206, 1983
57. Sardi JE, Giaroli A, Sananes C, et al: Long-term follow-up of the first randomized

trial using neoadjuvant chemotherapy in stage IB squamous carcinoma of the cervix: The final results. Gynecol Oncol 67:61–69, 1997
58. Schneider A, Possover M, Kamprath S, et al: Laparoscopy-assisted radical vaginal hysterectomy modified according to Schauta-Stoeckel. Obstet Gynecol 88:1057–1060, 1996
59. Sedlis A, Bundy BN, Rotman MZ, et al: A randomized trial of pelvic radiation therapy versus no further therapy in selected patients with stage IB carcinoma of the cervix after radical hysterectomy and pelvic lymphadenectomy: A Gynecologic Oncology Group Study. Gynecol Oncol 73:177–183, 1999
60. Sevin BU, Ramos R, Gerhardt RT, et al: Comparative efficacy of short-term versus long-term cefoxitin prophylaxis against postoperative infection after radical hysterectomy: A prospective study. Obstet Gynecol 77:729–734, 1991
61. Sevin BU, Ramos R, Lichtinger M, et al: Antibiotic prevention of infections complicating radical abdominal hysterectomy. Obstet Gynecol 64:539–545, 1984
62. Sutton GP, Bundy BN, Delgado G, et al: Ovarian metastasis in stage IB carcinoma of the cervix: A Gynecologic Oncology Group study. Am J Obstet Gynecol 166:50–53, 1992
63. Tattersall MHN, Ramirez C, Coppleson M: A randomized trial of adjuvant chemotherapy after radical hysterectomy in stage Ib–IIa cervical cancer patients with pelvic lymph node metastasis. Gynecol Oncol 46:176–181, 1992
64. Yagi H: Extended abdominal hysterectomy with pelvic lymphadenectomy for carcinoma of the cervix. Am J Obstet Gynecol 69:33–47, 1955
65. Yang YC, Chang CL: Modified radical hysterectomy for early IB cervical cancer. Gynecol Oncol 74:241–244, 1999

Address reprint requests to
William J. Hoskins, MD
Memorial Sloan-Kettering Hospital
1275 York Avenue
New York, NY 10021