



CHAPTER 51

Cancer of the Cervix

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DEFINITIONS

FIGO staging—The International Federation of Gynecology and Obstetrics (FIGO) has defined staging of gynecologic cancers for more than 50 years. The cancer stage defines the extent of disease at diagnosis before treatment. FIGO staging is used worldwide to compare clinical experience and results of treatment.

Lymphovascular space invasion (LVSI)—Small endothelial-lined vessels within the cervical stroma may be either lymphatic vessels or small capillaries. On histologic examination of a surgical specimen, tumor cells or clusters of tumor cells are sometimes seen in these vessels. Tumor invasion or involvement of these lymphovascular spaces is generally believed to increase the risk of nodal metastases and worsen prognosis.

Parametrium—Connective tissue lateral to the cervix and uterus within the broad ligament.

Pararectal space—The avascular space in the posterolateral pelvis. It is bounded medially by the rectum, laterally by the pelvic wall, posteriorly by the presacral fascia, and anteriorly by the broad ligament and cardinal ligament. During pelvic surgery, we commonly define the boundaries of the pararectal space as follows: laterally, the internal iliac system and medially, the ureter and mesoureter.

Paravesical space—The avascular space in the anterolateral pelvis is bounded by the bladder medially, the pelvic sidewall laterally, and the broad ligament and cardinal ligament posteriorly. During pelvic surgery, we define the paravesical space into two spaces—the lateral paravesical space components are bound laterally by the external iliac vessels and medially by the obliterated umbilical artery. The medial paravesical space is bound medially by the bladder and laterally by the obliterated umbilical ligament. Opening this medial paravesical space facilitates the identification of the uterine artery at its origin from the internal iliac vessel.

SEER database—The Surveillance, Epidemiology and End Results Database is managed by the U.S. National Cancer Institute. It collects data from population-based tumor registries around the country that represent a cross section of 23% of the population.

Sentinel lymph node—The sentinel node is the first node involved in lymphatic metastases from the primary cancer. The sentinel node concept holds that lymph node metastasis occurs in an orderly, stepwise progression so that if the first, or *sentinel node*, is negative, then the ensuing nodes are unlikely to be involved with metastatic cancer. Because cervical cancer is a midline tumor that may spread to either pelvic side and perhaps by more than one lymphatic pathway, these sentinel nodes are bilateral, and frequently, more than one node is identified on either side of the pelvis.

In the first half of the 20th century, more women died from cervical cancer in the United States than from any other cancer. With the introduction of the Papanicolaou (Pap) smear in the 1940s, the early detection and treatment of preinvasive disease became possible. Consequently, both the incidence and mortality rates due to invasive cervical cancer in the United States declined approximately 75% by the end of the 20th century. In the United States, approximately 11 to 12 thousand women will be diagnosed with new invasive cervical cancer annually. It is also estimated that approximately 3 to 4 thousand women will succumb to the disease annually. Based on these figures, cervical cancer currently ranks as the third most common female genital tract malignancy in the United States (behind uterine corpus and ovarian cancer).

Worldwide, however, the burden of this disease remains large, with estimates of 300-400 thousand new cases annually and approximately 200 thousand deaths per year. This makes cervical cancer not only the most common gynecologic malignancy but also the third most frequently diagnosed cancer in women (behind breast and colorectal cancer). In general terms, the disease is much more common in developing countries, with 80% of worldwide cases occurring in these areas. In developing countries, cervical cancer accounts for 15% of female malignancies, carrying a lifetime risk of approximately 3%. In contrast,





the cervical cancer lifetime risk is approximately 1% in developed countries. The highest incidence rates are observed in Latin America, the Caribbean, sub-Saharan Africa, and Southern and Southeast Asia. This geographical disparity is often attributed to the presence or absence of effective screening and treatment programs, since epidemiologic and biologic studies have not shown significant differences in tumor biology in countries with high rates of cervical cancer.

STAGING OF CERVICAL CANCER

In 1937, the Health Organization of the League of Nations adopted a clinical classification system for cervical cancer, making it the first cancer to be classified so. In 1950, this classification was modified to include preinvasive (in situ) cervical cancer, which was designated stage 0. New recommendations for the clinical classification of carcinoma of the cervix were adopted by the General Assembly of the International Federation of Gynecology and Obstetrics (FIGO) in 1961, and several other modifications have been made since. The general use of this classification abroad and in the United States has been extremely helpful in reporting and comparing results of various modalities of therapy. Descriptions of the clinical stages in carcinoma of the cervix uteri as updated by FIGO in 2009 appear in [Table 51.1](#) and [Figure 51.1](#).

The major redefinition and refinements involve stage I disease. Microinvasive (stage IA) carcinoma has been subdivided into stage IA1 and IA2 based on the depth of cervical stromal invasion by carcinoma. Stage IB has been subdivided into stage IB1 and IB2 based on the size of the clinical lesion.

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TABLE 51.1 Staging of Carcinoma of the Cervix Uteri (FIGO Committee on Gynecologic Oncology, 2009)

Stage I			The carcinoma is strictly confined to the cervix (extension to the corpus would be disregarded).
	IA		Invasive carcinoma that can be diagnosed only by microscopy, with deepest invasion ≤ 5 mm and largest extension ≥ 7 mm
		IA1	Measured stromal invasion of ≤ 3.0 mm in depth and extension of ≤ 7.0 mm
		IA2	Measured stromal invasion of >3.0 mm and not >5.0 mm, with an extension not >7.0 mm
	IB		Clinically visible lesions limited to the cervix uteri or preclinical cancers greater than stage IA ^a
		IB1	Clinically visible lesion ≤ 4.0 cm in greatest dimension
Stage II		IB2	Clinically visible lesion >4.0 cm in greatest dimension
			Cervical carcinoma invades beyond the uterus, but not to the pelvic wall or to the lower third of the vagina.
	IIA		Without parametrial invasion
		IIA1	Clinically visible lesion ≤ 4.0 cm in greatest dimension
		IIA2	Clinically visible lesion >4 cm in greatest dimension
	IIB		With obvious parametrial invasion
			The tumor extends to the pelvic





Stage III		wall and/or involves the lower third of the vagina and/or causes hydronephrosis or nonfunctioning kidney. ^b
	IIIA	Tumor involves the lower third of the vagina, with no extension to the pelvic wall.
	IIIB	Extension to the pelvic wall and/or hydronephrosis or nonfunctioning kidney
Stage IV		The carcinoma has extended beyond the true pelvis or has involved (biopsy proven) the mucosa of the bladder or rectum. A bullous edema, as such, does not permit a case to be allotted to stage IV.
	IVA	Spread to adjacent organs
	IVB	Spread to distant organs

^a All macroscopically visible lesions—even with superficial invasion—are allotted to stage IB carcinomas. Invasion is limited to a measured stromal invasion with a maximal depth of 5.00 mm and a horizontal extension of not >7.00 mm. Depth of invasion should not be >5.00 mm taken from the base of the epithelium of the original tissue—superficial or glandular. The depth of invasion should always be reported in mm, even in those cases with “early (minimal) stromal invasion” (~1 mm).

The involvement of vascular/lymphatic spaces should not change the stage allotment. ^b On rectal examination, there is no cancer-free space between the tumor and the pelvic wall. All cases with hydronephrosis or nonfunctioning kidney are included, unless they are known to be due to another cause.

HISTOPATHOLOGY

The principal histologic type of invasive cervical cancer, occurring in approximately 80% of cases, is the *squamous (epidermoid)* lesion. In 1923, Martsloff classified these squamous tumors into three main histologic subtypes and grades. Grade 1 tumors contain well-differentiated cells, keratin, and squamous pearls ([Fig. 51.2A](#)). Grade 2 tumors, the most common, are predominantly composed of transitional cells of the large cell nonkeratinizing type ([Fig. 51.2B](#)). Grade 3 tumors, the least common, are poorly differentiated small basal cell-type tumors ([Fig. 51.2C](#)). The classification of Martsloff did not prove to be clinically useful, mainly because biopsies taken from different areas of the same tumor often show different degrees of differentiation and different predominant cell types. Martsloff's work did inspire Broders, Wentz and Reagan, and others to continue to categorize the histologic types and degree of differentiation of squamous cell cervical tumors and to study their clinical behavior and response to treatment. The histologic classification of squamous cell tumor types introduced in 1959 by Wentz and Reagan is sometimes used in pathology reports. However, Willen and coworkers were unable to confirm a predictive value for survival from the Wentz-Reagan classification. Similarly, most recent studies, including those by the Gynecologic Oncology Group (GOG), have shown that grading squamous carcinomas has little predictive value.

A rare form of squamous cell cancer of the cervix is a *verrucous carcinoma*. It is a very well-differentiated squamous cell carcinoma with extensive keratinization that usually presents as a large bulky tumor of the cervix and often is confused with giant condylomas, such as those seen on the vulva. There is a sharp line between the tumor and underlying cervical stroma. Verrucous carcinoma, like most cervical cancers, has been shown to be associated with human papillomavirus (HPV) infection. Although metastatic disease is rare, this tumor has been noted to become more virulent if treated with irradiation. Goldberger and coworkers reported an unusually aggressive verrucous carcinoma of the cervix. According to deJesus and coworkers, at least 49 cases of this tumor have been reported in the female genital tract, sometimes as verrucous carcinoma and sometimes as squamous papillary tumor.

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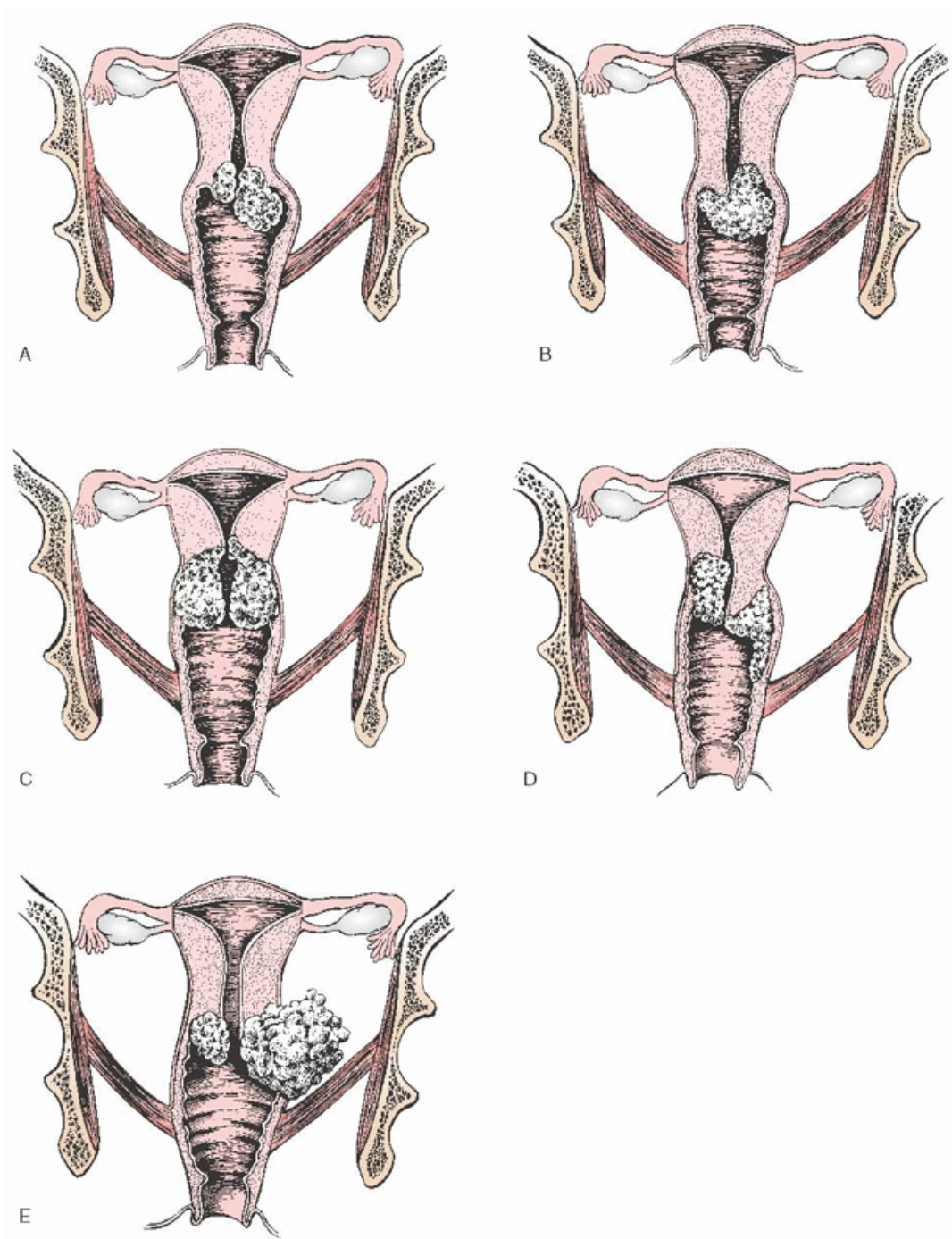


FIGURE 51.1 FIGO classification of carcinoma of the cervix. **A:** Stage IB: Carcinoma confined to the cervix, exophytic. **B:** Stage IB: Carcinoma is confined to the cervix, “cauliflower” lesion. **C:** Bulky stage IIA lesion with involvement of the vaginal fornix. **D:** Stage IIA: Carcinoma extends into the upper vagina or fornix. **E:** Stage IIB: Carcinoma extends into the parametrium but does not extend to the pelvic wall.

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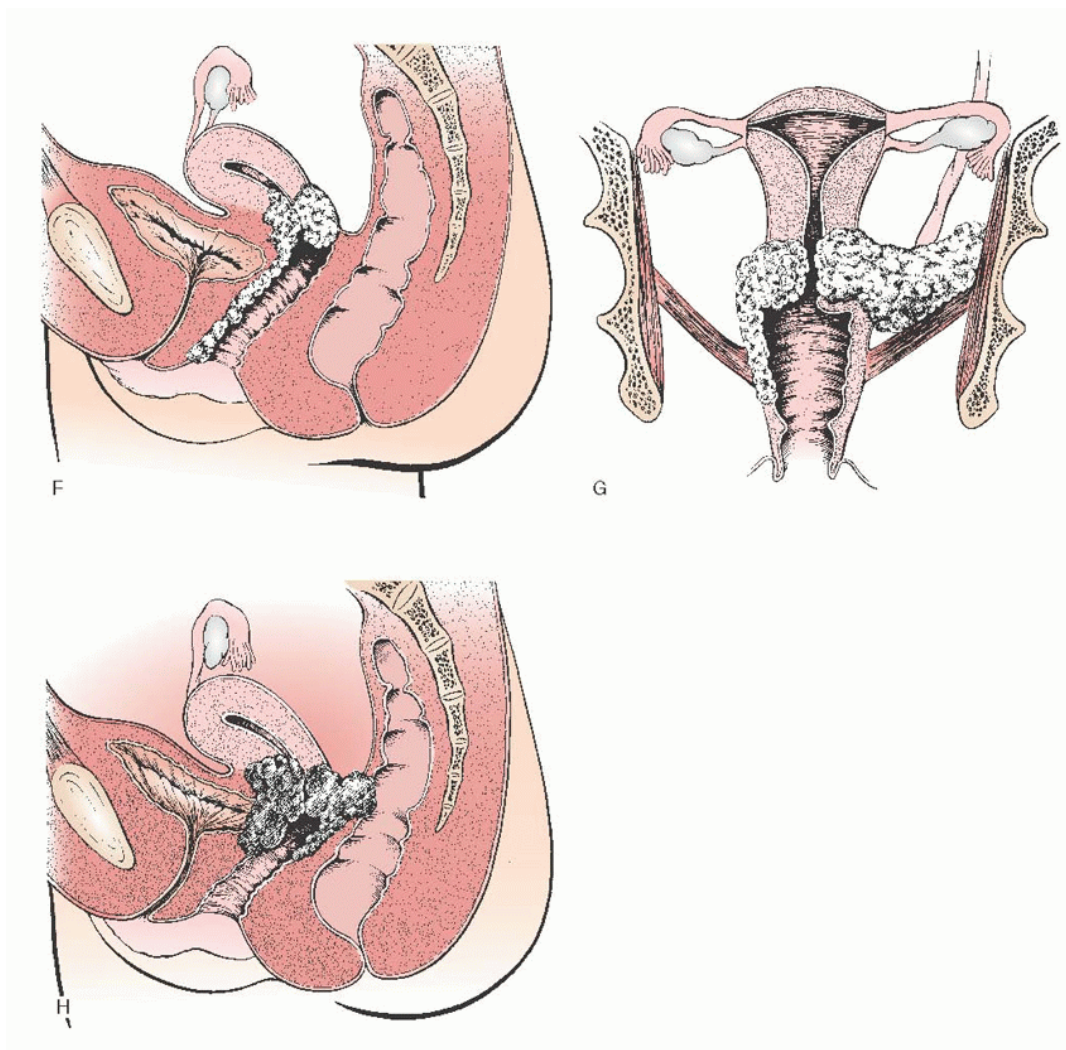


FIGURE 51.1 (Continued) **F:** Stage IIIA: Carcinoma involves the anterior vaginal wall, extending to the lower third. **G:** Stage IIIB: The parametrium is infiltrated, and the carcinoma extends to the pelvic wall. **H:** Stage IVA: The bladder base or rectum is involved.

Adenocarcinomas of the cervix are becoming more common, especially in younger women. In a review of the Surveillance, Epidemiology, and End Results (SEER) Cancer Incidence Public-Use database from 1973 to 1996, Smith and colleagues reported that although the age-adjusted incidence rates per 100,000 for all invasive cervical cancers and squamous cell cancers decreased by 37% and 42%, respectively, the rates for adenocarcinoma of the cervix increased by 29% during the study period. These results suggest that current screening practices may be insufficient in detecting a significant proportion of adenocarcinoma precursor lesions.

Approximately one half of cervical adenocarcinomas are exophytic, usually polypoid, or papillary; others diffusely enlarge or ulcerate the cervix. Approximately 15% of patients have no visible lesion because the epicenter of the carcinoma is within the endocervical canal. Even without visible signs or symptoms, the lesion may infiltrate deeply into the cervix. Drescher and colleagues reported a higher frequency of uterine corpus invasion and nodal metastasis in 26 patients with cervical adenocarcinoma compared with 139 cases of squamous cell carcinoma. More recent studies have reached contradictory conclusions regarding the prognostic significance of this histology compared to the squamous counterpart. In general, most practitioners would treat stage I cervical cancer of squamous or adeno histology in a similar manner, without much regard to the histology. This is drastically different from the approach to stage I small cell neuroendocrine tumors and other rare tumors, such as adenoma malignum, which tends to be much more lethal.

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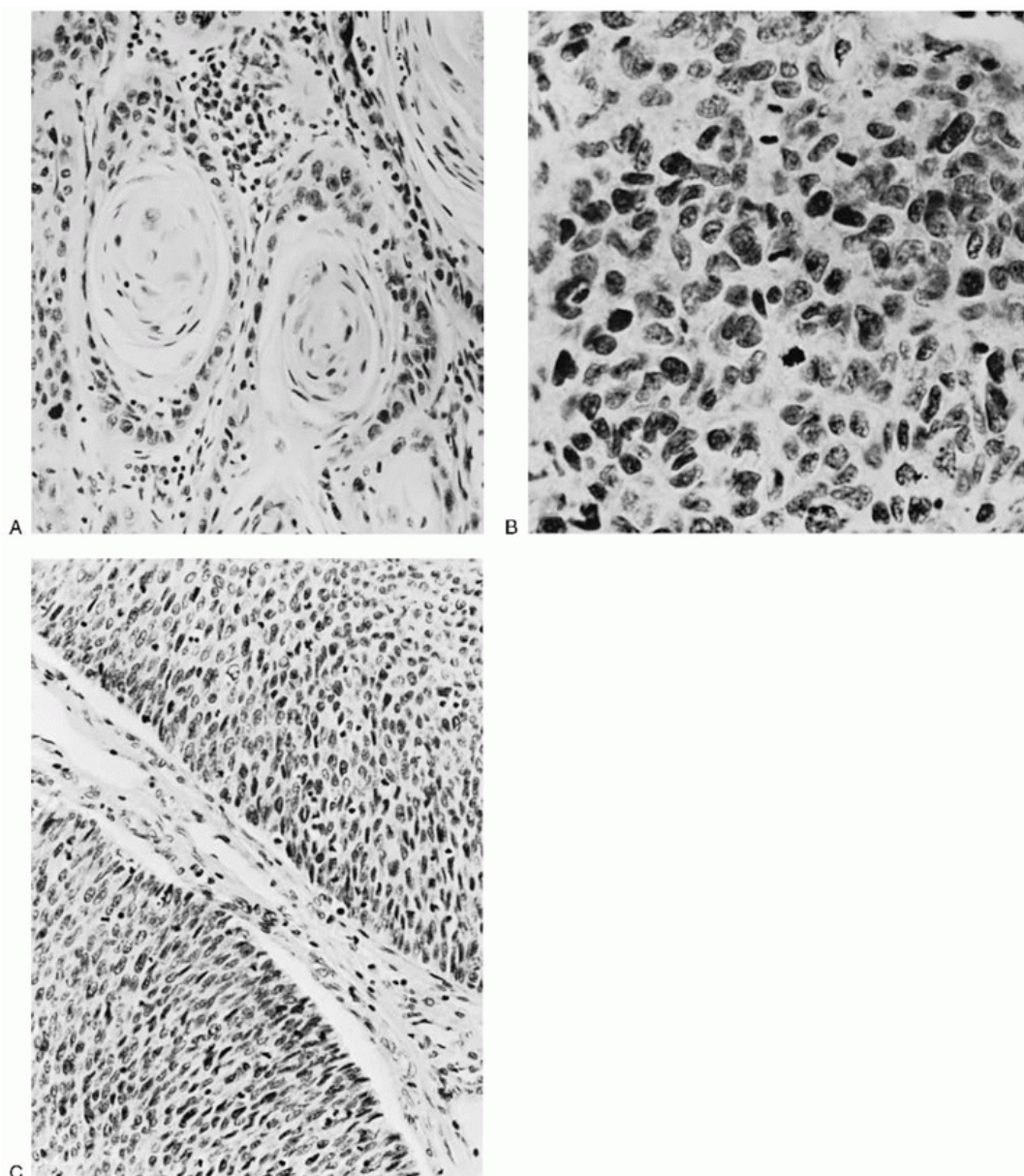


FIGURE 51.2 **A:** Grade 1: Well-differentiated epidermoid carcinoma of the cervix. High-power view of spinal cell type. The tumor cells contain abundant keratin that forms epithelial pearls. **B:** Grade 2: Moderately differentiated epidermoid carcinoma of the cervix, transitional cell type. The tumor cells are characterized by a moderate amount of cytoplasm but are without pearl formation. Extensive pleomorphism and mitosis are evident. The tumor is frequently classified as being of large cell, nonkeratinizing type. **C:** Grade 3: Poorly differentiated epidermoid carcinoma of the cervix, fat spindle or basal cell type. The tumor cells have little cytoplasm, numerous mitoses, and no keratin or epithelial pearls.

In addition to pure (endocervical) adenocarcinoma ([Fig. 51.3](#)), cervical adenocarcinomas can exhibit a variety of patterns and can be composed of diverse cell types. Other histologic patterns include *endometrioid*, *clear cell*, *serous*, *mesonephric*, and *adenoma malignum*. Different histologic patterns and cell types often appear in the same cervical tumor. Because mixtures are common, the designation of tumor type is based on the predominant component. In general, if a second histologic type constitutes 20% or more of the tumor, the lesion is designated as a *mixed cell type*, but pathologists also use various criteria to distinguish mixed lesions. Not infrequently, an adenocarcinoma and squamous cell carcinoma coexist in the same tumor, and these lesions are referred to as *adenosquamous carcinomas*. The so-called glassy cell adenocarcinoma of the cervix is rare and considered a variant of poorly differentiated adenosquamous carcinoma. It is known to be clinically (*Print pagebreak 1197*) aggressive, with frequent early distant metastasis. *Clear cell adenocarcinoma* of the cervix can occur in the presence or absence of intrauterine exposure to diethylstilbestrol (DES). Saigo and coworkers found that the endometrioid pattern was associated with a more favorable prognosis than any was other histologic type of cervical adenocarcinoma; however, other authors believe that the subpatterns have no prognostic significance. DES-related neoplasia is rarely seen by most practitioners, but clear cell neoplasia of the cervix unrelated to DES is occasionally encountered.



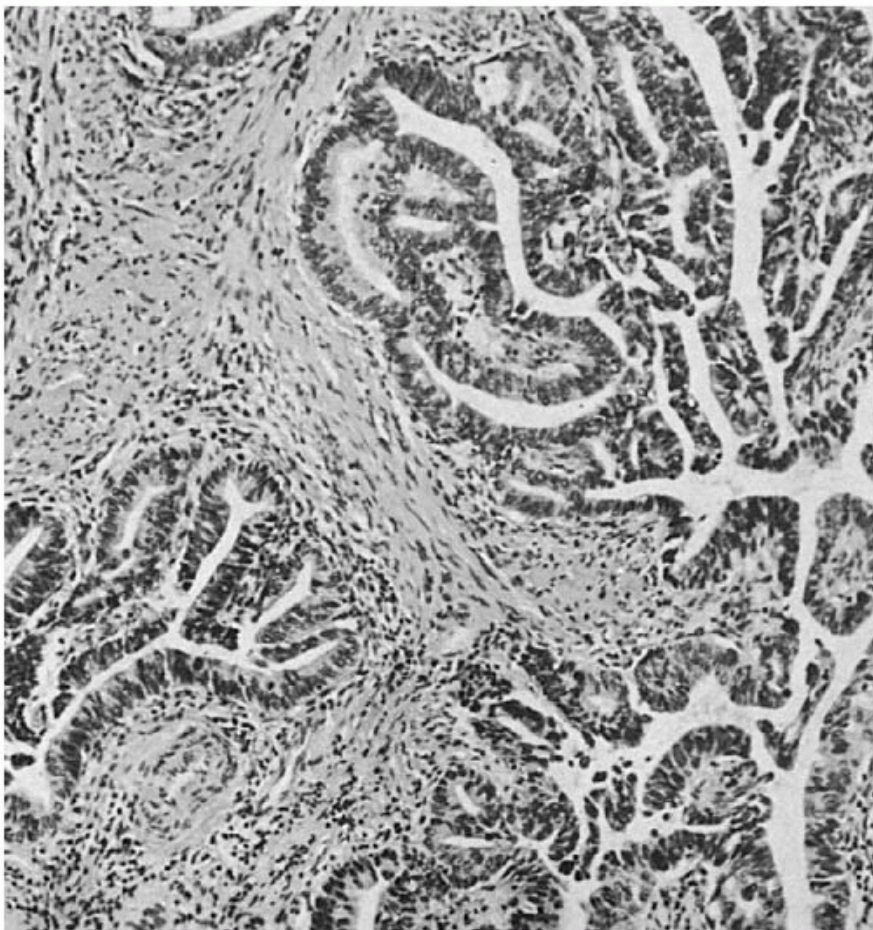


FIGURE 51.3 Adenocarcinoma of the cervix.

The early classifications of squamous cell carcinoma of the cervix proposed by Martzloff and others divided these tumors into three categories: keratinizing squamous cell carcinoma, large cell nonkeratinizing squamous cell carcinoma, and small cell carcinoma. Over the years, however, it became apparent that the subgroup designated as *small cell carcinoma* was composed of a heterogeneous group of tumors, many of which displayed neuroendocrine differentiation. Recent changes in the nomenclature have led to the subdivision of these *neuroendocrine tumors* into four categories: carcinoid, atypical carcinoid, large cell neuroendocrine carcinoma, and small cell carcinoma. Typical carcinoid and atypical carcinoid tumors are rare in the cervix; therefore, their clinical and pathologic features have not been well characterized. Large cell neuroendocrine and small cell carcinomas are highly aggressive neoplasms, with a propensity to metastasize early and widely. Usual methods of therapy incorporate systemic chemotherapy to treat potential distant metastasis, even in apparent clinical stage I disease.

Various *cervical sarcomas* have been described by Rotmensch and coworkers. These tumors constitute less than 0.5% of all cervical cancers and include adenosarcomas, leiomyosarcomas, carcinosarcomas, and rhabdomyosarcomas. Melanoma may also develop in the cervix and upper vagina and is often highly lethal. It is extremely rare for a lymphoma to develop primarily in the cervix, but lymphoma in the cervix is more likely to represent evidence of generalized lymphomatous disease.

CLINICAL PRESENTATION

Invasive cervical cancer is more likely than are its intraepithelial precursors to cause symptoms such as *abnormal vaginal bleeding* (menorrhagia, metrorrhagia, postcoital bleeding, or postmenopausal bleeding) or discharge. Many patients describe a profuse and often malodorous discharge, especially when the disease is advanced. Thus, any patient with abnormal vaginal bleeding or discharge should have a pelvic examination, including a speculum examination with visualization of the cervix. Failure to examine and visualize the cervix in a patient with abnormal vaginal bleeding or discharge could result in failure to diagnose cervical cancer.

Pain is not a common symptom in patients with cervical cancer, unless the disease is locally advanced and has invaded the adjacent pelvic structures, including pelvic nerves. In more advanced stages, patients may report bladder and rectal symptoms. When the disease involves lumbosacral and sciatic nerve roots and the lateral pelvic sidewall, chronic pelvic pain radiating down the leg can be excruciating and indicative of advanced disease. Edema of the lower extremities likewise indicates tumor obstruction of lymphatic and/or venous drainage and is a sign of advanced disease. Palpable supraclavicular or inguinal adenopathy may indicate





distant spread and should be evaluated to exclude nodal spread. Ascites is uncommon in cervical cancer. Peritoneal dissemination is uncommon in early stages and is highly lethal regardless of histologic subtype.

Unfortunately, the physician cannot rely on the presence of symptoms to lead to a diagnosis of early carcinoma of the cervix. Many women remain without symptoms for many months. Approximately one third of patients with advanced-stage (III or IV) disease report symptoms for less than 3 months. The only way to diagnose cervical cancer in the earliest possible stages is to routinely apply special diagnostic procedures to large groups of women with and without gynecologic symptoms. This means screening the adult female population with Pap smears and cervical HPV testing at set intervals.

Invasive cervical lesions can be exophytic, infiltrative, ulcerative, or occult. The size of the visible lesion on the cervix may correlate with the depth of stromal invasion, but exceptions do occur with superficial exophytic lesions ([Fig. 51.4](#)).

An everted exophytic carcinomatous growth may be friable. Bits of tissue may break off on the examining fingers. On inspection, the friable exophytic cancer shows a rough, granular bleeding surface that can be sloughing and infected, with a foul-smelling discharge.

A tumor that develops beneath the mucosa of the ectocervix and infiltrates the cervical stroma usually causes cervical enlargement (expansion). The surface of the cervix may still feel smooth, but the cervical consistency to palpation is firm, hard, or nodular. It is characteristic of cervical cancers that develop in the endocervical canal to cause cervical enlargement and a firm cervical consistency before breaking through the mucosa of the exocervix to cause a visible lesion on speculum exam. This also is characteristic of some cervical cancers that develop in postmenopausal women. In fact, it is possible, although uncommon, for a cervical cancer that is developing from an epicenter high in the endocervical canal to invade the parametrial tissue and even obstruct the ureters before causing a visible cervical lesion. An ulcerative lesion can look like a large punched-out ulcer, but more commonly, it is an irregular crater with a necrotic bleeding base and a foul-smelling discharge. The normal contour of the cervix is absent in these ulcerative cases, and complete loss of a significant portion of the ectocervix is common.

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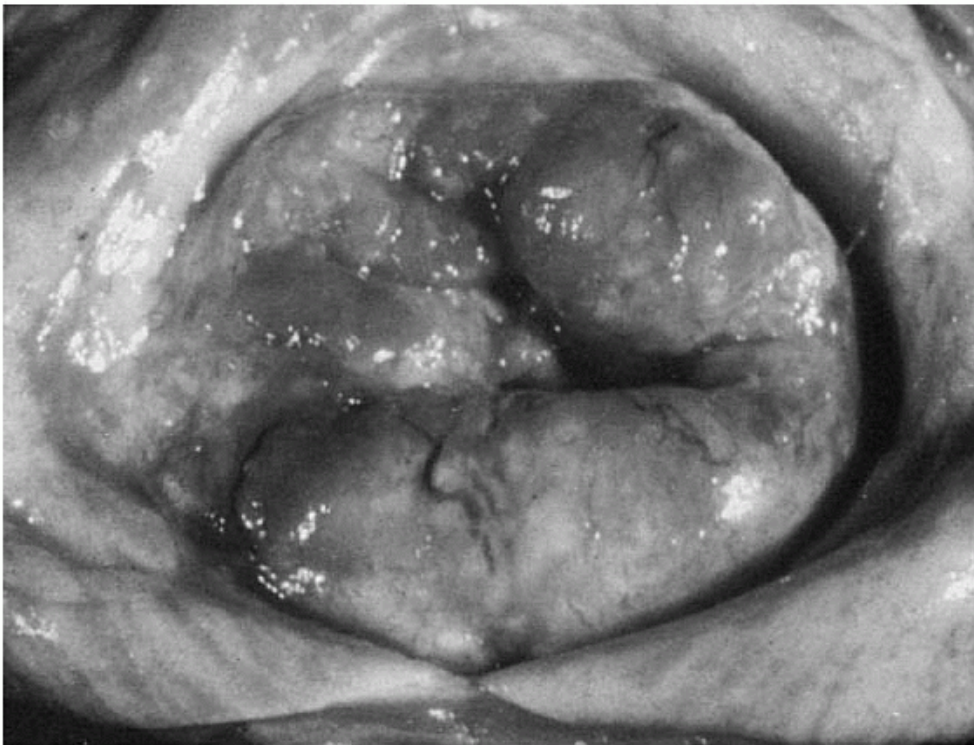


FIGURE 51.4 Squamous cell carcinoma, cervix uteri, FIGO stage IIA.

Any grossly visible lesion of the cervix should be considered suspicious for cancer, and biopsy should be performed. Good visualization with a speculum and adequate illumination are essential. A Pap smear can be performed, even though it can be less accurate in the presence of a grossly visible cervical lesion, but the main diagnostic procedure should be a biopsy.

Colposcopic examination is neither needed nor particularly effective for a gross cervical lesion but can be helpful when there is a small surface lesion to identify the most abnormal area for directed biopsies. The primary benefit of colposcopy is in visualizing noninvasive, precursor, or minimally invasive lesions that cannot be visualized without magnification.





Cervical biopsy techniques are discussed in another chapter. Biopsies can be undertaken with any of a number of special instruments: The Kevorkian ([Fig. 51.5](#)), Younge, or Gaylor biopsy forceps are particularly functional for taking an adequate biopsy specimen. It is important to obtain a sufficient specimen where frank stromal invasion can be demonstrated. Surgical conization under anesthesia is unnecessary when a grossly visible lesion is present. Iodine (Schiller) staining can be used to demarcate the vaginal margins of a neoplastic area from adjacent normal epithelium. All of these procedures, as well as the popular loop diathermy conizations (LEEP), can be done in the outpatient setting. It is rarely necessary to take the patient to the operating room to diagnose cervical cancer. If an anesthetic is deemed necessary for some other reason, a careful pelvic examination under anesthesia, biopsy of any vaginal lesions, cervical and uterine sounding, cystoscopy and proctoscopy (if warranted), and even uterine curettage can be done; therefore, useful information to plan treatment can be obtained.

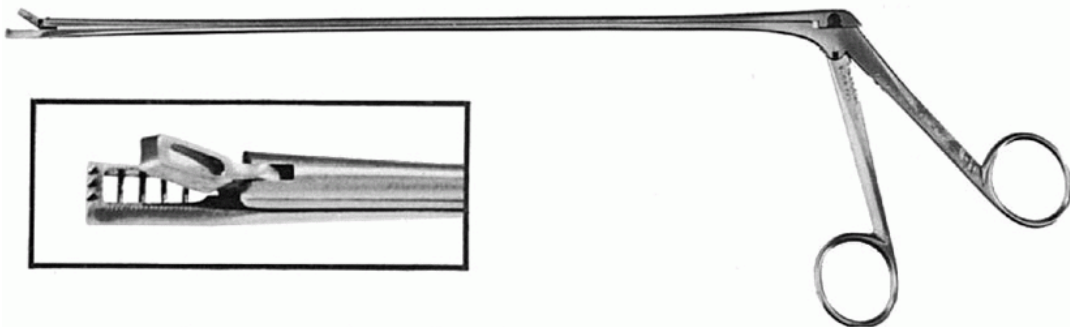


FIGURE 51.5 Kevorkian square-jawed cervical biopsy forceps.

PROGNOSTIC FACTORS

Several factors have been reported to affect prognosis in cervical cancer. However, the most important determinant of prognosis remains FIGO clinical stage. Based on studies by Piver and colleagues, van Nagell and associates, Delgado and coworkers, and numerous others that have demonstrated the prognostic significance of depth of cervical stromal invasion (DSI) and clinical or histologic tumor size in early-stage disease, FIGO incorporated these factors into its current clinical staging system by subdividing stage I. The 5-year survival rates by stage as reported by FIGO are shown in [Table 51.2](#).

In addition to FIGO stage, other reported prognostic factors include regional (pelvic) and distant (paraaortic) lymph node metastases, lymphovascular space invasion (LVSI), and select histologic subtypes, such as the small cell neuroendocrine tumors mentioned earlier.

Uterine corpus and endometrial cavity extension from primary cervical cancer was originally deemed a poor prognostic factor. The original League of Nations classification of 1937 included such lesions in the stage II category. Over the years, classification of the disease based on extension to the uterine corpus or endometrial cavity has gradually been discounted. These lesions, classified as stage IC in 1950, were included in (*Print pagebreak 1199*) the broad category of stage IB in 1961. Despite the change in classification, there is still some concern about patients whose tumor extends into the corpus of the uterus; this is of paramount importance in fertility-sparing radical trachelectomy cases. Evidence from Washington University reported by Perez and coworkers showed that tumor extension into the endometrial cavity lowers the 5-year survival rate of stage IB and IIA lesions by 10% to 20%. Lesions that involve the corpus also were found to have a twofold greater incidence of distant metastases compared with lesions without corpus extension. Similar observations have been reported by Prempre and coworkers from 82 cases of stage I and II disease with endometrial extension. The absolute 5-year cure rates of 68% for stage I and 62% for stage II disease with endometrial extension reflect the higher risk of metastases: 20% for stage I cases and 24% for stage II cases. Such reports must be studied with consideration of the difficulty of establishing a diagnosis of endometrial extension by using microscopic study of endometrial curettage specimens. The curettage specimen is frequently contaminated by the cervical tumor, making it difficult to be certain about endometrial extension. Treatment planning is not altered by such observations, nor is a fractional curettage recommended as part of pretreatment evaluation.

TABLE 51.2 Five-Year Survival by Figo Stage

STAGE	NUMBER OF PATIENTS	5-YEAR SURVIVAL RATE (%)
Ia1	860	98.7
Ia2	227	95.9
IB1	2,530	88.0





IB2	950	78.8
IIA	881	68.8
IIB	2,375	64.7
IIIA	160	40.4
IIIB	1,949	43.3
IVA	245	19.5
IVB	189	15.0

From International Federation of Gynecology and Obstetrics.

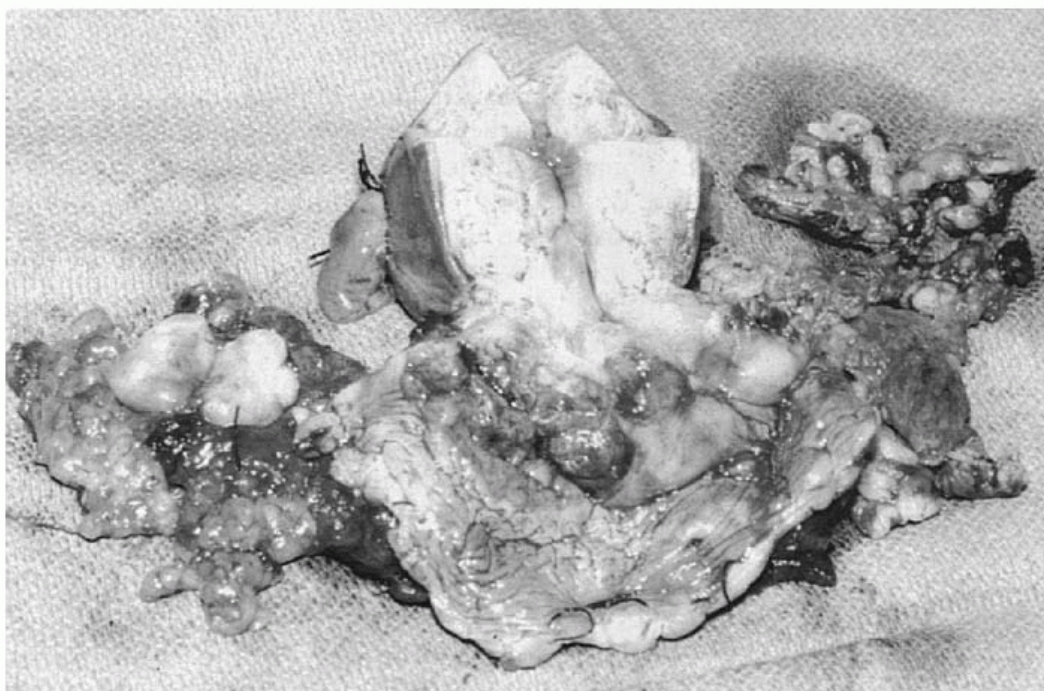


FIGURE 51.6 Squamous cell carcinoma, cervix uteri, FIGO stage IIA, with gross metastatic tumor in a right parametrial lymph node.

Lymph node metastases, either regional (pelvic) or to higher-level (common iliac and paraaortic) lymph nodes, have proven to be one of the most reliable prognostic factors for patients with cervical cancer ([Fig. 51.6](#)). The frequency of metastases to pelvic lymph nodes is approximately 0% to 1% for patients with stage IA1, 7% to 9% for stage IA2, 12% to 20% for stage IB, 20% to 38% for stage IIA, 16% to 36% for stage IIB, and greater than 35% for stage III and IV disease. Historically, preoperative detection of positive pelvic and paraaortic lymph nodes was unreliable; however, with the advent of newer radiologic imaging techniques, such as positron emission tomography (PET) scan, radiologic imaging has significantly improved the detection of nodal metastasis. Nevertheless, detection of positive lymph nodes is best made by pathologic evaluation and more accurately determined when lymphadenectomy or sentinel lymph node (SLN) mapping is used in preoperative staging or treatment. Although Kolstad showed that when intraoperative lymphography is used, 15% to 25% more patients with stage IB disease are found to have positive regional lymph nodes, this technique is rarely used nowadays and is mostly of historical relevance. The development of cervical injection techniques for SLN mapping has become a more accepted strategy in conjunction with pelvic lymphadenectomy to map early cervical cancer and determine nodal status.

When patients with stage IB cervical cancer are primarily treated with radical hysterectomy and pelvic lymphadenectomy, the 5-year cure rate is approximately 90% if there are no lymph node metastases. However, if metastatic disease to lymph nodes is detected, the 5-year cure rate falls to approximately 65% to 80%. The number of positive nodes also influences prognosis. In a review of the literature before the current standard of postoperative concurrent chemoradiation therapy, (*Print pagebreak 1200*) Hoskins reported an 83% survival rate for patients with stage IB and IIA disease who had negative lymph nodes at the time of radical hysterectomy and pelvic lymphadenectomy. The survival rate decreased to 57% in patients with one to two positive nodes and 31% in those with more than three positive nodes.

Metastatic disease to paraaortic lymph nodes occurs in 4% to 7% of patients with stage I disease, 15% to 20% with stage II disease, 25% to 30% with stage III disease, and 30% to 50% with stage IVA disease. Most studies confirm that metastasis to paraaortic nodes occurs more frequently when positive pelvic nodes also are present. The rarity of patients found to have isolated positive





para-aortic nodes when pelvic nodes are negative raises the question: How well sampled and/or sectioned were the pelvic nodes? With more incorporation of SLN mapping and pathologic ultrastaging of pelvic nodes, it is likely that the incidence of isolated aortic nodal metastasis will be even less than previously reported. Even with extended-field radiation therapy, the 5-year survival rate for patients with metastases to the para-aortic nodes is only approximately 25% to 35%. Combined modality chemoradiation is a standard of care in many countries for node-positive cases. The addition of more chemotherapy after definitive chemoradiation has been investigated and is gaining popularity as a consolidation strategy in advanced cases.

Historically, tumor grade has been reported to affect prognosis. Early studies by Chung and coworkers and van Nagell and colleagues demonstrated a poorer prognosis among patients with poorly differentiated tumors. However, more recent studies by Zaino and the GOG have shown the grading of squamous tumors to be of little predictive value in cervical carcinoma. Shingleton and Orr reviewed nine publications that reported on 3,761 patients with predominantly squamous cell carcinoma. Twenty-eight different factors were evaluated for prognostic significance. *On multivariate analysis, tumor volume, lymph node metastasis, parametrial invasion, and LVSI were found to be significant independent prognostic factors, but patient age and tumor grade were not.*

On the other hand, tumor differentiation may have a significant prognostic role in adenocarcinoma of the cervix. Shingleton and Orr also reviewed eight studies of 577 patients with adenocarcinoma of the cervix. As with squamous cell carcinoma, the strongest independent prognostic variables were tumor size and nodal metastasis. However, unlike with squamous cell carcinoma, tumor grade appeared to have prognostic significance.

Several investigators, including Swan and Roddick, Wheelless and Graham, and Julian and coworkers, have drawn attention to the fact that when there is a mixture of adenocarcinomatous and squamous elements—so-called adenosquamous tumors—the prognosis is poor and the incidence of pelvic lymph node metastases is high. Histologic combinations should be considered when comparing the prognoses of adenocarcinoma and squamous cancers of the cervix. The literature is mixed on the overall issue of whether adenocarcinoma in general and adenosquamous cancers specifically are more virulent and less curable than are their squamous counterparts. Stehman and colleagues performed a multivariate analysis of prognostic variables for 626 patients with locally advanced cervical carcinoma treated with radiation therapy on three GOG protocols. Histologic cell type was not found to be a significant prognostic factor. A national pattern of care and evaluation study of the American College of Surgeons also failed to report statistically different 5-year survival rates for squamous and adenocarcinoma, regardless of type of therapy chosen.

In a landmark GOG prospective study of 645 patients with stage IB squamous cell carcinoma of the cervix treated with radical hysterectomy and pelvic lymphadenectomy, Delgado and colleagues identified three independent risk factors in relation to disease-free survival: the depth of invasion, the size of the tumor, and LVSI. The disease-free interval was 89% for patients without LVSI compared with 77% for those with LVSI. Although not all studies have found LVSI to be an independent prognostic factor, as stated, in a review of nine studies (including the study by Delgado et al.) of 3,761 patients, Shingleton and Orr found LVSI to be a significant independent prognostic factor on multivariate analysis. The incidence of LVSI in early-stage lesions varies widely, depending on multiple factors, including the number of sections of the cervix prepared, the depth of stromal invasion, and the interest of the examining pathologist. Observations from Austria and Germany indicate that there is considerable variation in the frequency with which LVSI is recognized by the pathologist. In a combined study of more than 1,000 patients at three different reference centers (Graz, Munich, and Erlangen), Burghardt and associates reported that the frequency with which LVSI was identified ranged from 9% in Munich, where only blood vessel involvement was so classified, to 43% in Graz, where it was classified as capillary-like space involvement. At the third center, Erlangen, the corresponding value was intermediate at 23%. Such variations in histopathologic criteria may well contribute to some of the controversy that exists regarding the prognostic significance of LVSI. LVSI in itself, although a risk factor for nodal metastasis, is not a contraindication to consider and offer fertility-sparing surgery, such as radical trachelectomy.

To this point, this discussion of prognostic factors has included only anatomic and morphologic factors. Peipert and associates emphasized that cancer, including cervical cancer, has both form and function. Accordingly, other clinical variables, such as the patient's symptoms, symptom severity, and comorbidity, affect the survival rate of patients with invasive cervical cancer. Unless these variables are suitably included such as in nomograms, prognostic estimates based on morphology alone are imprecise, and therapeutic evaluations can be misleading. According to Rutledge and associates, there is no consistent effect of age on survival rate in patients treated for cervical cancer. Younger patients with early-stage disease seemed to survive longer than did older patients, but the tendency reversed when disease was advanced.

PRETREATMENT EVALUATION AND STAGING

When a diagnosis of invasive cervical cancer has been established, the clinician should perform an evaluation of relevant pelvic organs to determine whether the tumor is confined to the cervix or has extended to the adjacent vagina, parametrium, bladder, ureters, or rectum. To determine clinical stage, a pelvic exam with palpation, inspection, and estimation of tumor involvement and measurements is allowed; in addition, a conization is also allowed as a staging tool in occult early-stage lesions. According to FIGO





guidelines for clinical staging, diagnostic studies may include intravenous urography (IVU), cystoscopic examination of the bladder and urethra, a proctosigmoidoscopic study, a barium enema (BE), and in the case of early-stage disease, a colposcopic study of the vagina and the vaginal fornices. Colposcopic findings may be used for assigning a stage to the tumor (for instance, FIGO stage IIA), but the results must be confirmed by biopsy. Standard x-rays, (*Print pagebreak 1201*) such as a chest x-ray and routine bone films, are allowed for staging. Chest radiographs and electrocardiographic studies are also used to determine cardiopulmonary disease, particularly in the older patient. Advanced imaging modalities with pelvic MRI, computerized tomography (CT), and whole-body PET scan, although very useful to help triage treatment, are not available to the majority of women in developing nations.

When studies detect ureteral obstruction, a tumor is classified as a stage IIIB lesion, regardless of the size of the primary lesion. Ureteral obstruction, either hydronephrosis or nonfunction of the kidney, is well established as an indicator of poor prognosis, as recognized in the FIGO classification system. Retrograde pyelography can be performed after the ureteral obstruction is located for further evaluation, and stenting of the blocked ureter is frequently considered. Kidney function studies such as serum creatinine and creatinine clearance provide important baseline information before treatment; complete urinalysis is useful for detecting the presence of albumin or white and red blood cells and renal tubular casts. The majority of women with advanced cervical cancer will be candidates for chemotherapy, and maintaining good renal function is important in these patients.

In women with bulky or advanced-stage tumors, the bladder mucosa also should be inspected cystoscopically for possible bullous edema, which indicates lymphatic obstruction within the bladder wall. Evidence of tumor in the bladder must be confirmed by biopsy before the lesion can be classified as stage IVA. Urine cytology is usually not sufficient to make that diagnosis. Rectal mucosal lesions from cervical cancer are infrequent and also require a biopsy via proctosigmoidoscopy, because they can be related to an inflammatory or other neoplastic process rather than to the cervical tumor.

A pelvic examination must be performed as part of the staging process, and it may be necessary to have the patient completely relaxed by general anesthesia for a satisfactory exam. In as many as 20% of patients, the initial clinical classification of the disease based on office evaluation has been proven to be incorrect based on findings at the time of pelvic examination under anesthesia. Such an examination can reveal a more advanced stage of the disease than was originally found; additional biopsies (if indicated) or fractional curettage can be done, as well as colposcopy, cystoscopy, and proctosigmoidoscopy. In today's health care climate, however, the cost of a separate examination under anesthesia may need to be reserved for only the most problematic cases. Moreover, the advancements in pelvic MRI quality are giving gynecologic oncologists better information about the extent of locally advanced cervical neoplasia.

A main goal of tumor staging is to define prognostic groups, to enable clinicians to compare disease status, screening efficacy, treatment results, and other health care outcomes. The present form of the FIGO cervical cancer staging system is in principle a series of definitions of the most important prognostic features of cervical cancer, and it has been used in treatment protocols for generations. However, in the present form of the system, some of the stages do not refer to the presence or absence of paramount prognostic features that are recognized as definition criteria for lower (previous) stages. For example, stage IIA is defined as vaginal vault spread of the disease. Stage IIB does not contain information about the disease involvement of the vaginal vault (presence or absence of criteria for stage IIA), although extensive tumor spread to the vaginal vault seems to be at least as significant a prognostic factor as parametrium involvement (definition of stage IIB). Likewise, stage IIIB does not describe the presence or absence of a condition described in stage IIIA, although extensive tumor spread to the lower parts of the vagina (criteria of stage IIIA) is indeed a severe prognostic sign that should be considered in treatment planning. Similar weaknesses of the staging system include the lack of tumor size description in stage IIB and upper stages. (This problem was recognized by the new staging system, which differentiates between stage IIA1 and IIA2.)

The introduction of a more complex system of stages might better define prognostic groups, but inevitably, it would be more difficult to use and would make it difficult to collect large enough patient cohorts in a given substage for research. However, considering these weaknesses of the FIGO staging, a descriptive combination of the FIGO stages might be used in daily practice. For example, a patient with a bulky tumor involving the vaginal vault, inner half of the parametrium with hydroureter, should be defined as stage IIIB disease (based upon the ureter compression). But the disease (prognosis) might be better defined by adding information about criteria of previous stages, stating, for example, this is stage IIIB disease, with features of stage IIA2 and IIB, that is, no lower vaginal invasion or pelvic sidewall invasion.

Using an extension or combination of findings from lower stages might help to better define prognostic groups, explain results, and create treatment suggestions for special conditions without the need for creating a completely new and more complex staging system.

Pretreatment pedal lymphangiography has been used in the past to detect pelvic and paraaortic lymph node metastases, but the procedure is tedious and associated with many falsenegative and false-positive findings. When compared with lymphadenectomy, positive lymphangiograms have an accuracy rate of less than 75% and a false-negative rate as high as 50%. Furthermore, a lymphangiogram only detects metastatic lesions when the parenchyma of the lymph node has become distorted, by which time the





lesions are macroscopic. The procedure is therefore not recommended for routine use in the pretreatment evaluation of cervical cancer patients and is mostly mentioned nowadays for historical value.

Surgical experience from pelvic lymphadenectomy has confirmed an error rate of 15% to 25% in the clinical staging of patients with stage IB or II lesions. In 10% to 30% of cases with stage II or III tumors, in addition to positive findings of occult pelvic lymph nodes, other metastases may be found in the paraaortic nodes. Unfortunately, pelvic examinations and clinical staging as defined by FIGO cannot detect such metastases. Consequently, there is a growing body of literature showing the superiority of cross-sectional imaging (CT, MRI, and PET) over clinical staging in delineating the extent of disease in patients with cervical cancer. As stated earlier, official FIGO guidelines do not incorporate the use of advanced imaging, such as PET and MRI, into the staging of cervical cancer. This is due to FIGO's determination to create guidelines with universally available staging methods so that staging can be a standardized means of communication between different institutions worldwide. However, as knowledge of prognostic factors and the value of cross-sectional imaging have accumulated, its use in treatment planning has increased despite the lack of change in the official FIGO clinical staging guidelines, and in developed countries, MRI and PET scans are frequently performed as a routine part of the workup and management of suspected advanced cervical cancer.

In a Patterns of Care Study conducted between 1978 and 1988, Montana et al. reported a decrease in the use of IVU (86% to 42%) and BE (58% to 32%) in the staging of cervical cancer patients. During the same time period, the use of CT scan increased from 6% to 70%. In another Patterns of Care Study in the United States recently reported by Amendola (*Print pagebreak 1202*) and colleagues, the use of lymphangiography, IVU, and BE had fallen to 1% in the pretreatment evaluation of patients with clinical FIGO stage IB1 or greater cervical cancer who were scheduled for surgery.

The greatest value of a CT scan in the pretreatment evaluation of patients with cervical cancer is in the assessment of advanced disease (stage IB2 and greater) and in the detection and biopsy of suspected lymph node metastasis and possible ureteral obstruction. The treatment plan for patients with locally advanced disease must be modified if retroperitoneal lymph node involvement and/or distant metastasis is discovered. A meta-analysis by Schneider et al. reported a positive predictive value of 61% for CT scan in the pretreatment evaluation of nodal disease in cervical cancer. Moreover, in experienced hands, fine needle aspiration of retroperitoneal nodes with CT scan guidance has an accuracy rate of 80% to 95%. When the aspiration study unequivocally shows malignant cells, a surgical biopsy need not be performed. This information is most valuable in patients who have metastasis to the paraaortic nodes, because these patients would need the pelvic radiation fields extended to incorporate the involved region if there is no other evidence of distant metastasis. The use of laparoscopy and robotic surgery to “surgically stage” the paraaortic nodes is common in many practices, and pathologic evaluation of these nodes remains the most reliable strategy to exclude disease despite advances with imaging, such as PET scan. Recent studies have shown that even with a negative PET scan in the paraaortic region, a nodal dissection may identify a 10% to 15% nodal positivity on microscopic examination.

SURGICAL TREATMENT OF EARLY-STAGE CERVICAL CANCER

Based on the pretreatment evaluation of the patient, including the prognostic factors of tumor size, clinical stage of the disease, and risk of pelvic node metastases, a treatment schema can be developed for invasive cervical cancer, as shown in [Table 51.3](#). Almost all patients are treated with either primary surgery or primary radiation therapy with concurrent chemotherapy. Some patients are appropriately treated with combinations of all three. The standard management of patients with early cervical carcinoma is surgical removal of the cervix and pelvic nodal evaluation. The extent of resection of the surrounding tissue depends on the stage, size of the lesion, and the depth of cervical stromal invasion.

Stage IA1 Disease

The exact definition of early-stage cervical cancer has been debated for several decades. This is illustrated by the fact that FIGO changed the definition of early-stage cervical cancer at least five times since 1960. In 2009, FIGO made its most recent revision to the stage IA cervical cancer staging system. After an extensive evaluation of the data in the literature, as well as seeking advice from specialty societies and individuals worldwide, FIGO changed the definition of stage IA1 disease to lesions that invade the cervical stroma ≤ 3 mm in depth and ≤ 7 mm in width. Stage IA2 includes patients with >3 mm but <5 mm invasion and ≤ 7 mm lateral extent.

In an exhaustive review of the literature, Ostor identified 31 studies spanning the years 1976 to 1993 that reported on 3,598 patients with squamous cell carcinoma of the cervix and ≤ 3 mm stromal invasion. Although not all patients had lymph nodes removed as part of their treatment, the calculated incidence of lymph node metastasis in this group of patients was less than 1%.

TABLE 51.3 General Treatment Schema for Invasive Cervical Carcinoma [a](#)

DISEASE STAGE	TREATMENT
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Stage IA1	Simple hysterectomy, abdominal or vaginal, or cervical conization If there is LVI, consider sentinel node mapping or pelvic lymphadenectomy
Stages IA2 ^b , IB1, and nonbulky IIA	Radical (type C) ^c hysterectomy or trachelectomy, ^d bilateral pelvic lymphadenectomy (consider sentinel node mapping) with postoperative irradiation, ±concurrent chemotherapy in selected high-risk patients
Stages IB2 and bulky IIA ^e	Full external and intracavitary pelvic irradiation with concurrent chemotherapy (±extrafascial hysterectomy) or radical abdominal hysterectomy and pelvic (±periaortic lymphadenectomy)
Stages IIB to IVA ^f	Full external and intracavitary pelvic irradiation with concurrent chemotherapy
Stage IVB	Palliative chemotherapy

^aFor individual patients, recommendations for treatment can vary, depending on the clinical circumstances.

^bSome authorities recommend modified (type B) radical hysterectomy, bilateral pelvic lymphadenectomy for stage IA2 disease.^c Refer to [Figure 51.7](#).^dIn highly selected cases.^eSome authorities recommend simple hysterectomy in addition to radiation/chemotherapy for stage IB2 and bulky stage IIA disease.^fA patient with a stage IVA lesion that extends only in the anterior or posterior direction may be a candidate for pelvic exenteration.

Diagnosis

Microinvasive carcinoma cannot be diagnosed from a punch biopsy because adjacent areas may contain more advanced tumor; conization is required for definitive diagnosis in this situation. The accuracy of the diagnosis depends on the adequacy of the cone and the adequacy of the pathologic examination of the cone. The entire cone should be blocked so that an adequate number of histologic sections can be taken from each block. If the diagnosis is still not ascertainable, more sections should be made. Although some experts can obtain a large tissue specimen with negative margins using loop electrosurgical excision techniques for a satisfactory diagnosis of microinvasive cancer, a traditional cold-knife cone biopsy in the operating room under anesthesia is often preferable. This is thoroughly discussed in another chapter.

Treatment

In 1996, the National Institutes of Health (NIH) invited an international panel of experts to develop a consensus conference statement on cervical cancer. After an extensive literature review and presentation of the scientific evidence, they concluded that patients who have squamous cell carcinoma (*Print pagebreak 1203*) of the cervix with ≤3 mm stromal invasion and negative conization margins have virtually a 100% cure rate when treated with simple hysterectomy or conization alone. However, for patients treated by conization alone, both the internal conization margin and the postconization endocervical curettage must be negative for cancer and dysplasia, because the risk of residual invasive cancer is significantly increased if either the margin or the curettage is positive. The definition of a negative margin remains debatable, and whether no tumor at the inked margin is sufficient versus a 1- to 3-mm tumor-free margin remains to be determined, but it is preferable to have a nonfragmented specimen for evaluation of margins. The choice of therapy should also be influenced by the patient's desire to maintain fertility. Although LVSI generally is considered to be an adverse prognostic factor in cervical cancer, its prognostic significance in stage IA1 disease is uncertain. Because of this uncertainty, some clinicians suggested that the presence of LVSI in stage IA1 disease might be more appropriately treated with radical hysterectomy and pelvic lymphadenectomy. SLN mapping is gaining increasing credibility in early-stage cervical cancer, and stage IA1 cases with LVSI are reasonable candidates for SLN injection and mapping as a strategy to evaluate pelvic nodes.

Recurrence in the vaginal vault may be the result of failing to accurately define the extent of the lesion and the presence of involvement of adjacent vaginal mucosa. This usually can be prevented with a careful colposcopic examination before hysterectomy. If vaginal fornices are involved, partial vaginectomy may be easier to perform with hysterectomy if the operation is done vaginally ([Fig. 51.7](#)). Alternatively, if the woman is not a good surgical candidate, radiation therapy (usually in the form of brachytherapy alone) can be selected.

Increased infection morbidity has been reported with intracavitary irradiation of a recently coned cervix. The cervix must be





allowed to heal completely before intracervical irradiation. The survival rates for microinvasive disease (all treatments) should reach 98% to 99% if patients are adequately studied and properly treated.

Several studies of microinvasive adenocarcinoma of the cervix have been done. Webb and colleagues recently reviewed the SEER public-use database to identify 131 cases of cervical adenocarcinoma with 3-mm or less stromal invasion. Fifty patients had a radical hysterectomy and pelvic lymph node dissection, and none were found to have lymph node metastasis. Furthermore, there were no deaths among the 54 patients treated with simple hysterectomy alone. Others have reported a 0% rate of lymph node metastasis with depths of stromal invasion of up to 5 and 12 mm. However, bilateral pelvic lymph node metastases have been reported with as little as 2.5 mm of stromal invasion. Furthermore, Elliot and associates reported a case of lymph node metastasis with cervical adenocarcinoma with less than 1-mm invasion and a second case of recurrence and death after radical hysterectomy and pelvic lymphadenectomy in a patient with 1.8 mm of stromal invasion. From a clinical standpoint, stage IA1 adenocarcinoma is treated similarly to its squamous counterpart, except gynecologic pathology consultation is highly recommended in all cases of early cervical cancer to accurately determine the diagnosis and stage and to identify any LVSI. In summary, stage IA1 disease is highly curable with conization or trachelectomy or hysterectomy. The need to evaluate pelvic lymph nodes is appropriate to consider in women with LVSI or if higher stage is suspected and may be accomplished with SLN mapping or pelvic lymphadenectomy. Parametrectomy is being decreasingly utilized in true stage IA1 disease, and fertility-sparing surgery has become a standard of care with favorable oncologic and obstetrical outcomes in many women with early-stage cervical cancer.



FIGURE 51.7 Vaginal hysterectomy and partial vaginectomy specimen from a patient with squamous cell carcinoma, cervix uteri, FIGO stage IA1, with extension to adjacent vaginal fornix. Note uniform width of vaginal cuff.

If simple hysterectomy is subsequently chosen as the definitive surgical treatment after a conization, the hysterectomy should





be done within 48 hours of the conization or delayed until the cervix has healed, usually about 6 weeks later. If the hysterectomy is done after 48 hours and before the cervix has healed, the risk of postoperative infectious morbidity is increased. However, a radical abdominal hysterectomy and bilateral pelvic lymphadenectomy can be done at almost any time after cervical conization, even before the cervix is completely healed. The reason for this difference is not clear, but may be related to the fact that indurated and possibly infected paracervical and parametrial tissue is actually removed when a radical hysterectomy is done.

Stages IA2, IB1, and Nonbulky (≤ 4 cm) IIA Disease

The recommended treatment by the NIH Consensus Conference for patients with stage IA2 disease is primary radical or modified radical hysterectomy with bilateral pelvic lymphadenectomy or primary radiation therapy, because the risk of nodal metastases is 4% to 10% in these patients. Again, the diagnosis of both stage IA1 and IA2 diseases should be based (*Print pagebreak 1204*) on microscopic examination of removed tissue, preferably a conization or large loop excision specimen, which must include the entire lesion. For stage IA2 disease, the depth of invasion should not be more than 5 mm taken from the base of the epithelium, either surface or glandular, from which it originates. The second dimension, the horizontal spread, must not exceed 7 mm. Vascular space involvement, either venous or lymphatic, should not alter the staging but should be specifically recorded. The remaining stage I cases should be allotted to stage IB. All grossly visible lesions are defined as stage IB.

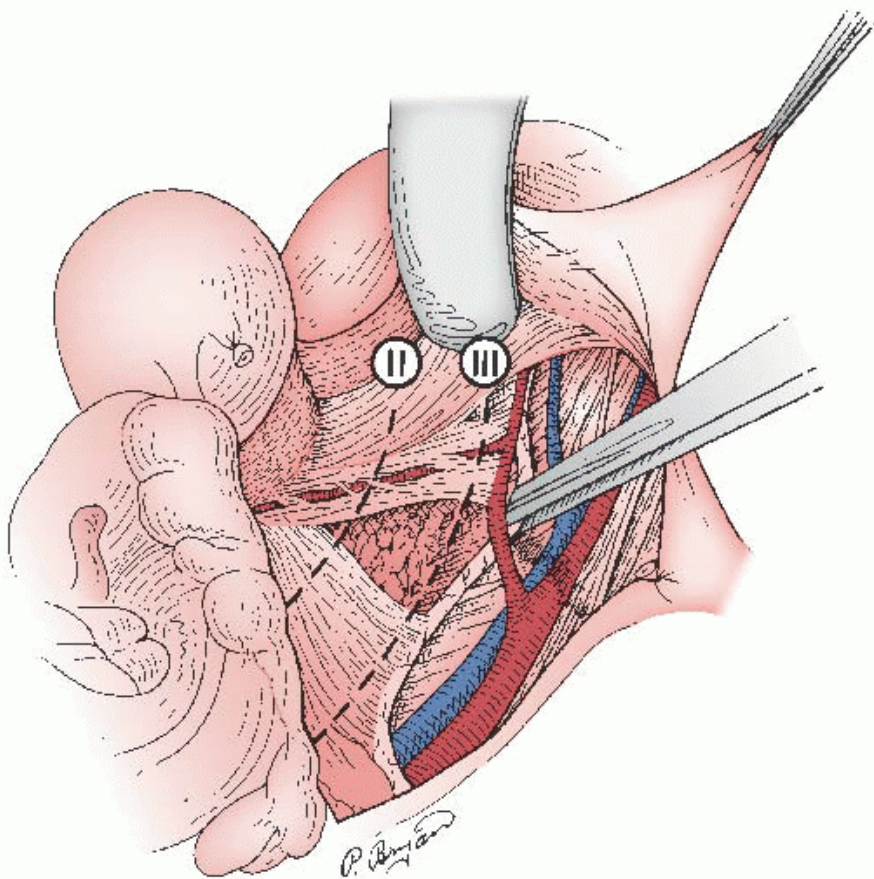


FIGURE 51.8 The cardinal ligament is excised medially in women with microscopic lesions (class II operation) or laterally in those with larger-volume lesions (class III operation). (Modified from Piver MS, Rutledge F, Smith JP. Five classes of extended hysterectomy for women with cervical cancer. *Obstet Gynecol* 1974;44:265, with permission.)

TABLE 51.4 Comparison of Extent of Resection for Surgical Procedures to Treat Early-Stage Cervical Cancer

TISSUE	CERVICAL CONIZATION	TOTAL ABDOMINAL/VAGINAL HYSTERECTOMY	MODIFIED RADICAL HYSTERECTOMY (TYPE B)	RADICAL ABDOMINAL HYSTERECTOMY (TYPE C)	RADICAL VAGINAL RACHAELECTOMY (TYPE B)	RADICAL VAGINAL HYSTERECTOMY (TYPE C)
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Cervix uteri	Partially removed	Completely removed	Completely removed	Completely removed	Majority removed	Completely removed
Corpus uteri	Preserved	Completely removed	Completely removed	Completely removed	Preserved removed	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	Descending cervicovaginal branch ligated	Ligated at level of ureter
Uterosacral ligaments	Preserved	Ligated at uterus	Divided midway to rectum	Divided near rectum	Partially removed	Partially removed
Vaginal cuff	Preserved	None removed	1-2 cm removed	≥2 cm removed	1-2 cm removed	≥2 cm removed

For stage IA2 disease, standard treatment is a type C1 (class III) nerve-sparing radical hysterectomy with bilateral pelvic lymphadenectomy; however, some authors recommend a type B (class II) modified radical hysterectomy ([Fig. 51.8](#)). The type B, or class II, hysterectomy removes the medial half of the cardinal and uterosacral ligaments, ligating the uterine artery at the ureter. This more conservative operation has been used by some authors in the past 3 decades to excise small primary tumors while reducing the partial bladder denervation associated with the complete excision of the cardinal and uterosacral ligaments required for a type C, or class III, hysterectomy. Five-year survival rates of 97% to 98% have been reported for patients with small cervical lesions treated with a type B, class II, hysterectomy. The role of the class II modified radical hysterectomy was recently evaluated in a randomized, prospective study reported by Landoni and colleagues. Two hundred forty-three patients with FIGO stages IB and IIA were randomized to either class II or III hysterectomy. The recurrence-free and overall survivals were similar between the two groups. Patients treated with type II radical hysterectomy had a statistically significant reduction in operative time and postoperative morbidity, particularly bladder dysfunction. However, given the relatively high cure rate for early cervical cancer treated by radical hysterectomy, larger trials are necessary to prove equivalence in survival between the two types of hysterectomy. As stated by Rose, larger trials are required before we can accept these results as the new standard of care. The estimated extent of tissue resection in surgical procedures for early cervical cancer is summarized in [Table 51.4](#).

(Print pagebreak 1205)

RADICAL HYSTERECTOMY

Historical Points in the Development of Radical Surgery for Cervical Cancer

Radical hysterectomy for cervical cancer was performed by John Clark while still a resident trainee at the Johns Hopkins Hospital in Baltimore in 1895; however, earlier reports describe the radical hysterectomy performed in 1888 by the Czech surgeon Pavlik. The procedure is linked in perpetuity to Wertheim of Vienna, who reported his series of 500 cases of radical extended abdominal hysterectomy and partial lymphadenectomy performed from 1898 until 1911. Despite the skill and enthusiasm of Wertheim, Schauta (who developed the vaginal radical hysterectomy in 1901), Okabayashi, and others, radical pelvic surgery was fraught with significant operative morbidity and mortality. Therefore, the introduction of radium brought irradiation to the forefront of primary treatment for carcinoma of the cervix for the next several decades.

In the United States, Joe V. Meigs reintroduced radical hysterectomy as the treatment of choice, publishing a series of 344 cases in 1945. Until formalization of training fellowships in gynecologic oncology in the early 1970s, many outstanding gynecologic surgeons in the United States (Parsons, Ulfelder, Green, and many others) made important contributions and modifications to the radical surgical approach that have markedly decreased complications while preserving the cure rate. Proficient performance of the radical hysterectomy remains a benchmark of the gynecologic oncology surgeon.

Patient Selection for Radical Hysterectomy

Simple hysterectomy is not adequate treatment for stage IB cervical cancer. In 1943, Jones and Jones reported a 5-year survival rate of only 41.6% in patients who had been treated for stage I cervical cancer with simple hysterectomy only. Such poor results also have been reported by Schmidt and others. When more than FIGO stage IA1 invasive cervical cancer is a surprise finding in a simple hysterectomy specimen, additional therapy—usually radiation therapy with or without chemotherapy—should be given postoperatively. Suggested indications for radical abdominal hysterectomy are summarized in [Table 51.5](#).





Although radical hysterectomy and pelvic lymphadenectomy occasionally are used to treat patients with adenocarcinoma of the endometrium with involvement of the cervical stroma (stage IIB) and, rarely, patients who have a small cervical cancer that persists or recurs in the cervix after primary radiation therapy, in this chapter, emphasis is given to the use of the operation as primary treatment for invasive cervical cancer.

In most institutions, the majority of patients with stages IA2, IB1, and nonbulky IIA cervical cancer are offered radical abdominal hysterectomy and bilateral pelvic lymphadenectomy as primary treatment.

Patients with bulky stage IB disease (currently FIGO stage IB2) have traditionally been treated with radical hysterectomy and bilateral pelvic lymphadenectomy or primary radiation therapy, with equivalent survivals. However, patients with these larger lesions treated surgically have a very high risk of having lymph node metastasis or close resection margins or local tumors risk factors, such as deep stromal invasion with LVSI, which are often reasons for postoperative pelvic radiation treatment. Landoni and colleagues performed a randomized trial of radical hysterectomy and pelvic lymphadenectomy versus pelvic radiation therapy for stage IB to IIA cervical cancer. Patients randomized to the surgery arm who had pathologic risk factors, such as lymph node metastasis, received adjuvant radiation therapy. Of the 55 patients with tumors greater than 4 cm, 46 (84%) required postoperative irradiation. The disease-free and overall survival rates for these patients treated with surgery and radiation therapy were the same as those for patients with bulky tumors treated with radiation therapy alone; however, the combination therapy significantly increased morbidity. Subsequently, a randomized trial performed by the GOG has demonstrated the benefit of the addition of cisplatin chemotherapy to pelvic radiation followed by extrafascial hysterectomy in this group of patients. Therefore, many experts feel that patients with FIGO stage IB2 and bulky IIA cervical cancer are best treated with concomitant cisplatin chemotherapy and radiation therapy with or without completion extrafascial hysterectomy.

TABLE 51.5 Indication for Radical Abdominal Hysterectomy

INDICATION	EXTENT OF DISEASE
Invasive cervical cancer	Stage IA1 with lymphovascular invasion Stage IA2 Stage IB1 Stage IB2 (selected) Stage IIA (selected)
Invasive vaginal cancer	Stage I-II (limited to upper one third of vagina, usually involving posterior vaginal fornix)
Endometrial carcinoma	Clinical stage IIB (gross cervical invasion)
Persistent or recurrent cervical cancer after radiotherapy	Clinically limited to cervix or proximal vaginal fornix

In the United States, patients with stage IIB invasive cervical cancer usually are excluded from primary treatment with surgery. They are usually treated with concomitant radiation therapy and chemotherapy. However, it should be noted that select stage IIB cases have traditionally been considered in some countries (Japan, Germany, Hungary, and other European countries) as an indication for primary radical hysterectomy. Recent studies from Japan demonstrated equal overall survival with a favorable quality-of-life outcome of radical hysterectomy compared to primary chemoradiotherapy in this stage of the disease. The question about radical hysterectomy indication in select stage IIB patients cannot be considered resolved; thus, although radical hysterectomy treatment of stage IIB cervical cancer is not suggested in this book, it should be considered as an acceptable alternative concept in the appropriate hands and clinical setup.

The clinical significance of parametrial involvement dates to the early studies of Kundra and Sampson. Kundra, working in Wertheim's clinic, studied more than 21,000 serial microscopic sections of the parametrium, finding that the parametrium of one or both sides was involved in 44 of 80 patients. In a similar study at the Johns Hopkins Hospital, Sampson pointed out that the parametrium could feel indurated and yet show no evidence of cancer. Also, the parametrium can feel normal and yet contain cancer. Sampson emphasized that only (*Print pagebreak 1206*) by the microscope can the surgeon exclude cancer involvement of the parametrium. More recently, Inoue and Okumura found parametrial extension in 7% of stage IB patients and in only 34% of stage IIB patients. Burghardt and Pickel found true parametrial involvement in only 19% of stage IIB patients. Matsuyama and coworkers found no parametrial cancer in 58% of stage IIB patients. These studies were based on careful examination of microscopic sections and reemphasize the difficulty of being certain about parametrial extension from pelvic examination alone, emphasizing the shortcomings of a clinical staging system. Inoue and Okumura studied 628 operative specimens from patients treated with radical hysterectomy and lymphadenectomy and found that parametrial extension is an important factor in the number of positive lymph nodes found and in patient survival. If there is suspicion of spread into the parametrial tissues by examination, CT scan, or MRI scan, it is reasonable to offer radiation therapy with concomitant chemotherapy as primary treatment (despite the fact that the official FIGO stage should remain unchanged).





The major point to be emphasized is that the gynecologic surgeon should not attempt to treat a patient with a large cervical tumor with primary radical surgery unless there is reasonable assurance that the operation will result in the complete removal of the central tumor with an adequate margin of tumor-free tissue around it. The surgeon should not operate on patients with the idea that radiation therapy with or without chemotherapy can be used postoperatively to eliminate residual fragments of tumor tissue after incomplete resection. Such patients usually are better treated with concurrent pelvic radiation and chemotherapy from the beginning.

Primary radical surgical treatment is not contraindicated in any histologic type of cervical cancer. Shingleton and coworkers have suggested that the survival of patients with stage I adenocarcinoma of the cervix is better with surgery than with irradiation. Patients with stage I adenosquamous cancer, clear cell cancer, and undifferentiated adenocarcinoma have a poorer prognosis, regardless of the method of treatment chosen, and therefore are often considered for adjuvant radiation therapy and/or chemotherapy after primary surgery.

Patients considered for radical hysterectomy must be acceptable candidates for an operation and free of serious medical problems that contraindicate extensive surgery. In former years, some institutions limited radical surgery as primary treatment to premenopausal women so that ovarian function might be conserved. As experience has accumulated, it has become apparent that the operation is also well tolerated by older women. In a study of 45 women aged 65 years and older with cervical cancer, Fuchtnr and associates concluded that age alone should not be a contraindication to extensive hysterectomy in the elderly patient with American Society of Anesthesiologists physical status I to III. Kinney and coworkers reported their experience with the Wertheim operation in a geriatric population. Thirty-eight selected women between 65 and 89 years of age (median age, 69 years) were compared with 320 patients younger than age 65. The survival rates were almost identical in the two groups. Perioperative morbidity was minimally increased in the geriatric group. Geisler recently compared the outcomes after radical hysterectomy and pelvic lymphadenectomy of 62 patients older than age 65 to 124 matched controls age 50 or younger. Even using this relatively younger cohort for comparison, there were no significant differences in operative mortality or morbidity. However, to achieve such excellent results in older women, Kinney and coworkers pointed out that “meticulous surgical technique, high-quality ancillary services, and support from internal medicine and anesthesia services” are required. Such extended supportive care is not available in every hospital.

Extreme morbid obesity presents especially difficult technical problems when radical surgery is chosen for primary treatment. Not only is the performance of the operation more challenging and possibly less satisfactory, but also there may be an increased risk of wound complications, postoperative infection, intraoperative hemorrhage, pulmonary embolus, pulmonary atelectasis, and anesthesia-related and other problems. Unfortunately, primary treatment with radiation therapy with or without chemotherapy also is frequently less than satisfactory in extremely morbid obese patients. The introduction of robotic minimally invasive surgery may play a role in treating select obese women with early cervical cancer, avoiding the need for laparotomy.

Studies by Soisson and Levrant compared outcomes after radical hysterectomy for cervical cancer in obese versus nonobese women. They found that survival was not compromised, and the incidence of serious complications was not increased in obese patients. However, in obese women, the authors reported that the operative technique is more difficult, the procedure lasts longer, and the surgery is associated with greater blood loss. Cohn and colleagues recently reported their results with radical hysterectomy for cervical cancer in 46 obese women. The median body mass index was 36 kg/m², and the median weight was 95 kg. Nine patients (20%) experienced postoperative morbidity, mostly related to wound complications. No patient developed a fistula. Massi and associates have reported that the Schauta-Amreich vaginal hysterectomy can be used as an alternative to the radical abdominal hysterectomy in the presence of obesity or elevated surgical risks.

According to Shingleton, primary treatment with radical surgery paradoxically also can be riskier in very thin patients because of a higher incidence of fistula. It is speculated that easy exposure and lack of excess fatty tissue in these patients may result in removing essential vasculature around the ureters and bladder, resulting in ischemic necrosis. A thin patient has less fat around the pelvic vessels and in the lymph fields; thus, the surgeon should be satisfied to remove less tissue in an operation that will still be adequate in a thin patient.

The management of the *pregnant patient* diagnosed with invasive cervical carcinoma is more challenging. First, a decision must be made to either save the pregnancy or treat the cancer. Pregnancy is not a contraindication to primary treatment of stage IB or IIA carcinoma of the cervix with radical surgery ([Fig. 51.9](#)). In 1974, Sall and coworkers reported on 29 patients with stage IB carcinoma of the cervix in pregnancy treated with radical hysterectomy and pelvic lymphadenectomy. At the time of publication, 28 patients were alive and well, and 23 patients had been followed for more than 5 years. There were no fistulae or major complications. Others have confirmed 5-year survival rates of 85% to 95% for patients treated with radical surgery for stage IB cervical cancer in pregnancy. Funnell and associates, operating on 17 pregnant patients, suggested that the associated pregnancy changes facilitated the surgical dissection. Sood and colleagues performed a case-control study comparing the outcomes after radical hysterectomy and pelvic lymphadenectomy for 26 pregnant versus 26 nonpregnant patients. Operative times and postoperative complication rates were similar between the two groups. There was a statistically significant increase in blood loss at the time of surgery for pregnant patients; however, there was no difference in the frequency of blood transfusion. Eleven patients underwent surgical treatment in the third trimester of pregnancy, with a mean planned delay in therapy of 16 weeks. None of the patients with





the planned delay in therapy developed recurrent disease. The authors concluded that surgical management of early cervical cancer is safe during pregnancy. In select obstetric patients who desire to maintain (*Print pagebreak 1207*) their pregnancies, Sood and colleagues agreed with the conclusions of Greer and coworkers that planned delay in therapy to increase the likelihood of fetal maturity is safe for early-stage I squamous cell cancers diagnosed in the late second and early third trimester. All other patients should be treated promptly in an attempt to cure the cancer.

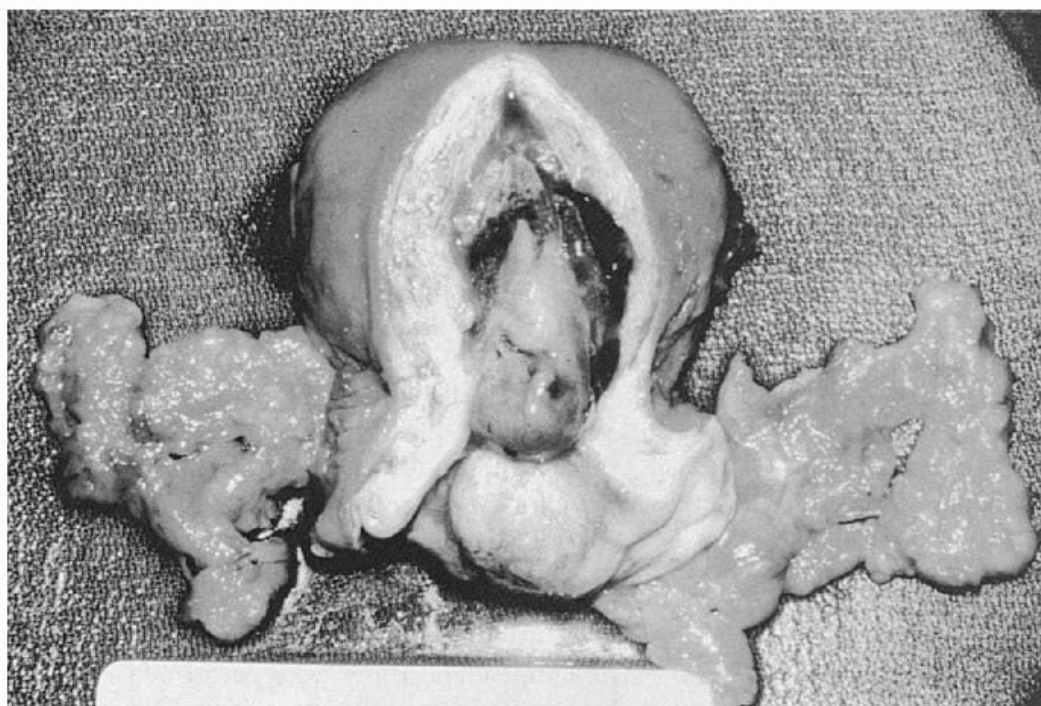


FIGURE 51.9 Squamous cell carcinoma, cervix uteri, FIGO stage IB with intrauterine pregnancy, 16 weeks (lymphadenectomy specimen not included).

Finally, based on data from Orr, Chapman, and others, extensive parametrectomy and pelvic lymphadenectomy appear to be appropriate management for selected patients found to have *unexpected invasive cancer of the cervix on pathologic examination of a uterus removed for benign conditions*. Low morbidity rates and acceptable rates of long-term disease-free survival have been reported. However, pelvic irradiation is usually recommended for these patients.

Advantages of Radical Surgery as Primary Treatment for Invasive Cervical Cancer

The most important considerations in choosing a method of therapy for any cancer are, first, effectiveness of the treatment in curing the disease and, second, mortality and morbidity rates associated with the treatment plan. For the indications listed previously, the cure rates of primary radiation therapy and primary extensive surgery are about equal. The modern mortality rates also are about equal. Both modalities of therapy have a list of complications unique to each that seem about equal. There are, however, important major and minor advantages of primary radical surgery over irradiation for early-stage disease, some of which are discussed in the following sections.

Accurate Evaluation of Extent of Disease

The findings at operation and from careful pathologic examination of the surgical specimen can be immensely helpful in selecting high-risk patients for adjuvant postoperative radiation therapy, chemotherapy, or both. Most patients with FIGO stages IA2, IB1, and nonbulky IIA disease are not found to have high-risk factors and thus are spared the potential morbidity associated with whole pelvic radiation therapy. Furthermore, the findings at operation and careful pathologic examination of the surgical specimen can be helpful in determining prognosis and in identifying patients at greatest risk for persistence or recurrence of disease. Such high-risk patients may require additional therapy.

In addition to an accurate assessment of the extent of the cervical cancer, primary surgical treatment allows for discovery of other intra-abdominal incidental conditions and diseases entirely unrelated to the cancer. Ovarian malignancies, pelvic tuberculosis, sigmoid diverticulitis, cholelithiasis, and other diseases and conditions may be encountered at the time of operation.





Preservation of Ovarian Function

When primary radiation therapy with or without chemotherapy is used to treat invasive cervical cancer in premenopausal women, premature loss of ovarian function is an unfortunate and inevitable result. When primary surgery is used instead, the function of normal ovaries can be conserved. Sutton and associates analyzed the incidence of ovarian metastasis for 991 patients with stage IB carcinoma of the cervix treated with radical hysterectomy and pelvic lymphadenectomy on a prospective GOG protocol. Ovarian spread was found in 4 of 770 patients (0.5%) with squamous cell carcinoma and in 2 of 121 patients (1.7%) with adenocarcinoma. The difference was not statistically significant. All six patients with ovarian metastases had other evidence of extracervical disease. This study confirmed that ovarian metastasis is rare in patients with stage IB cervical cancer and extremely rare in the absence of other evidence of extracervical disease.

Although the incidence of ovarian metastasis is slightly higher in women with adenocarcinoma of the cervix as compared with squamous cell carcinoma, ovarian conservation should still be considered, especially in young women. Brand and Berek reported no ovarian metastases in more than 60 patients with adenocarcinoma of the cervix treated with radical surgery. Angel and associates found no ovarian metastases in 41 patients with adenocarcinoma of the cervix who underwent oophorectomy. Greer and coworkers treated 55 patients with stage IB adenocarcinoma of the cervix with radical hysterectomy and pelvic lymphadenectomy. Ninety-one percent had ovarian preservation, and there was no evidence that this contributed to tumor recurrence. Hopkins and coworkers found that the best cumulative 5-year survival rate (93%) with cervical adenocarcinoma was in patients treated by radical hysterectomy without bilateral salpingo-oophorectomy and concluded that “ovarian conservation seems to be an acceptable alternative to bilateral salpingo-oophorectomy” in young patients.

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Some authors have advocated transposing the ovaries into the paracolic gutters at the time of radical hysterectomy in premenopausal women to protect the ovaries from radiation damage should postoperative pelvic radiation therapy be needed. The technique used for ovarian transposition was described by Hussein-zadeh and coworkers. However, in the series reported by Chambers and coworkers, there was a threefold increase in symptomatic benign ovarian cyst formation with lateral ovarian transposition compared with those who did not have their ovaries transposed. Furthermore, Anderson and coworkers reported that only 4 of 24 patients (17%) who had ovarian transposition retained ovarian function after postoperative radiation therapy. Moreover, after transposition, 17.6% of patients required surgical treatment for ovarian-associated pain or cysts. These data raise the question of whether paracolic gutter transposition actually achieves its goal of protecting the ovaries.

Sexual Function

Studies of the effect of surgical and radiation treatment for cervical carcinoma on sexual function have been published by Seibel and coworkers from Emory University and by others. Among patients treated with radiation, there are decreases in sexual enjoyment, ability to attain orgasm, frequency of intercourse, and desire for intercourse. Marked alterations can be seen and felt in the upper vagina and paravaginal tissues. The vagina usually is shorter from stenosis. The upper vagina is less pliable. Tissues are fixed and firm. The vaginal mucosa is thin, smooth, and dry, with a tendency to split and bleed with slight trauma. Some of these changes are made more pronounced in young women because of hypoestrogenism from radiation-induced premature menopause. They are not completely reversed by intravaginal or oral administration of estrogen. Such functional and anatomic changes are not seen nearly as frequently in patients treated with primary extensive surgery. Even if the vagina has been surgically shortened by several centimeters with primary surgery, it remains soft, pliable, moist, and functional. Unfortunately, in women who undergo postoperative adjuvant pelvic irradiation, some of these characteristics are lost.

Fewer Late Complications

Late complications after treatment for cervical cancer are rarely seen after primary radical surgery. They occur more often when patients are treated with primary radiation therapy. Because of the gradual and progressive obliterative endarteritis produced by irradiating tissue, complications resulting from ischemic changes (e.g., cystitis, proctitis, enteritis, colpocleisis, pyelonephritis) can be seen many years after radiation treatment. Late onset of complications after primary radical hysterectomy and pelvic lymphadenectomy are unusual. These points are especially important when selecting a method of primary treatment for young women.

Psychological Benefits

There are probably important psychological benefits of primary treatment with radical surgery compared with radiation therapy. Most patients prefer to have the tumor removed and are especially encouraged when the surgeon can report that “the cancer is out” and that no evidence of metastatic disease was found at operation. Radiation therapy carries an unfortunate connotation in some





patients who feel that it is the treatment of last resort, that the tumor is still there (albeit treated), or that irradiation will cause other cancers. All gynecologic surgeons have heard the disappointment patients express when they are told that they cannot be treated with an operation. Some patients continue to request an operation even after they have completed radiation therapy. It is paramount to counsel patients thoroughly and outline the many advantages modern radiation therapy may provide in select cases.

Justification for Pelvic Lymphadenectomy

Historically, there was competition between gynecologic surgeons who advocated radical vaginal hysterectomy without lymphadenectomy and those who advocated radical abdominal hysterectomy with lymphadenectomy. The advocates of extensive vaginal hysterectomy without lymphadenectomy (the Schauta-Amreich-Navratil operation) argued that their patients had fewer postoperative complications (especially urinary fistulae), a lower operative mortality rate, and a cure rate that was almost equal to that achieved by an abdominal operation that included lymphadenectomy. Furthermore, they pointed out that pelvic lymphadenectomy is an incomplete operation, at best, in that the removal of all pelvic lymph nodes that can possibly be involved with metastatic tumor is technically not feasible in many cases. This is especially important for those inferior gluteal nodes that are located in the region of the ischial spine, as pointed out by Reiffenstuhl. However, even Navratil stated in 1965 that “indications for the Schauta operation must take the lymph node problem into account.” Later, he performed extraperitoneal pelvic lymphadenectomy with the Schauta operation in all stage I and II cases that were locally advanced, as did Mitra, the Indian gynecologist who performed the pelvic node dissection through a bilateral extraperitoneal abdominal incision after radical vaginal hysterectomy.

In recent years, the operative mortality and complication rates in patients who have undergone radical abdominal hysterectomy and bilateral pelvic lymphadenectomy have significantly decreased. Operative mortality and fistulae occur in less than 1% and approximately 2% of patients, respectively. Therefore, one purported disadvantage of radical hysterectomy (high morbidity) has essentially been removed, and the surgeon can concentrate on the question of whether lymphadenectomy adds anything to the possibility of cure. If a pelvic lymphadenectomy is not done in patients who have a radical hysterectomy for cervical cancer, at least 15% to 20% of patients (those with positive nodes) will be inadequately treated for their disease (unless perhaps all patients receive postoperative pelvic irradiation). In our judgment, it is better to do a pelvic lymphadenectomy in all eligible patients and then give postoperative radiation therapy selectively than to avoid a lymphadenectomy and give postoperative radiation therapy to all patients.

It is the opinion of some that pelvic lymphadenectomy is of no value in those 80% to 90% of patients who have negative lymph nodes. We believe that lymphadenectomy is helpful in achieving an adequate central dissection around the cervical tumor, the most important part of the operation. This is especially true of that part of the lymphadenectomy that involves removal of tissue from around the hypogastric vessels, from the obturator fossa, and from the lower presacral region. Admittedly, dissection of lymph nodes from the common iliac vessels and from the paraaortic region does not add to the completeness of the central dissection. Removal of these and other nodes, however, is helpful in prognosis and in identifying patients at greater risk for persistent disease who might receive adjuvant postoperative radiation therapy to the pelvis and perhaps to extended fields along the aorta. Although we seldom dissect and remove the highest paraaortic lymph nodes, we do remove the lower paraaortic nodes around and just above the aortic bifurcation. If pelvic lymph nodes involved with tumor are found during the operation, a concerted effort is made to do a more complete paraaortic dissection. Although it is possible for paraaortic nodes to be directly involved without involvement of pelvic nodes, this is rare. For the group of patients who usually would be chosen for treatment with primary radical surgery, (*Print pagebreak 1209*) routine extensive paraaortic lymph node dissection would not result in a therapeutic benefit very often. Podczaski and coworkers found positive paraaortic lymph nodes in 7 of 52 patients (13.4%) with stage IB and IIA disease. Twenty-eight of the 52 patients, however, had bulky tumors greater than 5 cm in greatest diameter. Currently, such patients are considered by many gynecologic oncologists not to be appropriate candidates for treatment with primary radical surgery. Patsner and coworkers performed paraaortic lymph node sampling in patients with small (tumor ≤ 3 cm) stage IB cervical cancer. Only 2 of the 125 patients who underwent radical hysterectomy, bilateral pelvic lymphadenectomy, and paraaortic node sampling had metastases to the paraaortic nodes. No patient had gross paraaortic nodal involvement, and both patients with microscopic paraaortic nodal metastases had grossly positive pelvic nodal involvement. These investigators recommended that paraaortic sampling in patients with small stage IB cervical tumors be restricted to patients with suspicious or positive pelvic or paraaortic nodes. The paraaortic region should be carefully palpated and any enlarged or firm nodes removed, but the gynecologic surgeon should be aware of the added morbidity associated with comprehensive paraaortic lymphadenectomy.

A study reported by Downey and colleagues provides indirect evidence that postoperative pelvic irradiation is more effective in controlling disease after pelvic lymphadenectomy has removed clinically positive lymph nodes that contain metastatic tumor. The amount of irradiation required to eliminate tumor in lymph nodes is directly related to the volume of tumor present ([Table 51.6](#)). Thus, removing the larger nodes involved with tumor increases the probability of control of tumor with irradiation. Patients in this study who underwent resection of large positive pelvic nodes followed by postoperative extended-field irradiation had a surprisingly high 5-year recurrence-free survival rate of 51%. The advantages of surgical debulking of positive lymph nodes also were discussed by Potish and coworkers in a later study from the same center. No patient with unresectable pelvic nodes survived 5 years. In 84% (49/58) of cases with grossly positive pelvic nodes, the nodes were able to be debulked. The 5-year actuarial relapse-free survival





rates were the same for patients with only microscopically involved pelvic node metastases (56%) and for patients with grossly involved but surgically resected pelvic node metastases (57%). All patients with positive pelvic nodes received postoperative irradiation to the pelvis and paraaortic nodes. These authors believe that surgical debulking of grossly involved pelvic lymph nodes to microscopic residual disease may improve the chance of control with postoperative irradiation.

TABLE 51.6 Squamous Cell Carcinoma of the Cervix: Dose-Tumor-Volume Relation^a

TUMOR VOLUME (CM)	DOSE (GY)
<2	50
2	60
2-4	70
4-6	75-89
6	80-100

^aAverage radiation dose required to obtain 90% control in area treated.

From Shingleton HM, Orr JW. *Cancer of the cervix: Diagnosis and treatment*. New York, NY: Churchill Livingstone, 1987:174, with permission of Elsevier.

PERTINENT PELVIC ANATOMY ARTERIAL AND VENOUS ANATOMY

Although the lower portions of the aorta and vena cava are frequently incorporated into the operative field of the pelvic lymphadenectomy, the major operative dissection includes the common iliac, external iliac, and hypogastric (also known as the internal iliac) arteries and veins and their various branches and tributaries. The abdominal aorta emerges through the aortic hiatus of the diaphragm at the lower border of the last thoracic vertebra and descends along the ventral surface of the vertebral column, where it bifurcates into the left and right common iliac arteries at the fourth lumbar vertebra ([Fig. 51.10](#)). This is an important anatomic landmark because the bifurcation at L4 lies directly beneath the umbilicus in most cases. Therefore, an abdominal midline incision that provides surgical exposure to the lower aorta needs to be extended somewhat above the umbilicus. The right common iliac artery crosses the upper portion of the left common iliac vein at the aortic bifurcation. This segment of the venous drainage of the left side of the pelvis (*Print pagebreak 1210*) joins with the right common iliac vein to form the vena cava, which lies directly along the right side of the aorta and on the right lateral side of the bodies of the lumbar vertebrae in its retroperitoneal course through the abdomen.



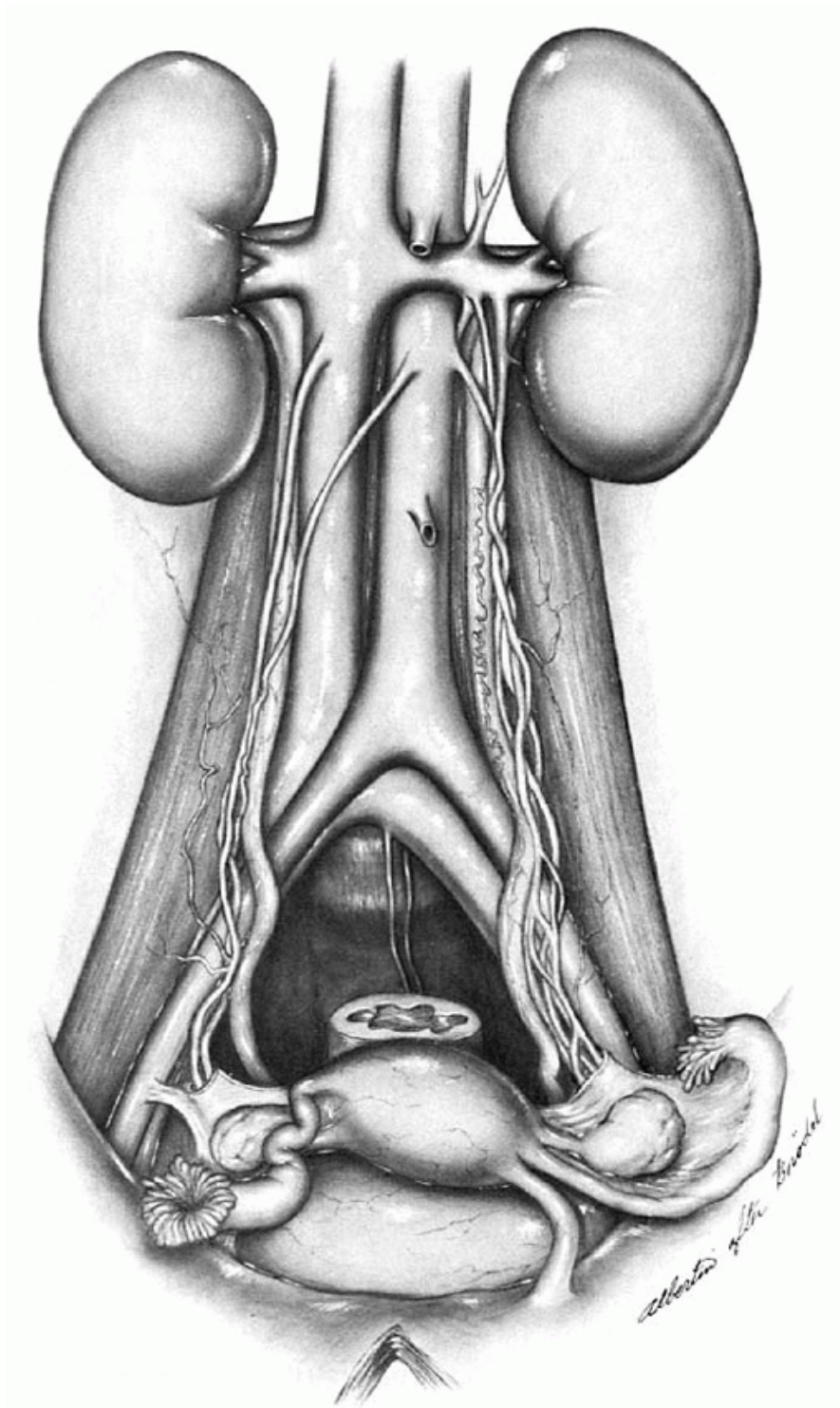


FIGURE 51.10 Abdominal and pelvic anatomy, showing the anatomic relations of the aorta, vena cava, iliac vessels, and ureters. Note the arteriovenous crossing of the right common iliac artery and the left iliac vein.

Both common iliac arteries continue along the medial border of the psoas muscle to the pelvic brim, where they divide into external iliac and hypogastric vessels. As shown in [Figure 51.10](#), this important vascular division marks the site where the ureters enter the pelvis from the abdomen, usually overlying the terminal end of the common iliac artery on the left and commonly crossing the actual bifurcation of the artery on the right. Both external iliac arteries pass beneath the inguinal ligament to proceed into the leg as the femoral artery. The external iliac artery makes no direct vascular contribution to the pelvis, although there is a fairly consistent arterial branch to the ureter from the midportion of the common iliac artery.



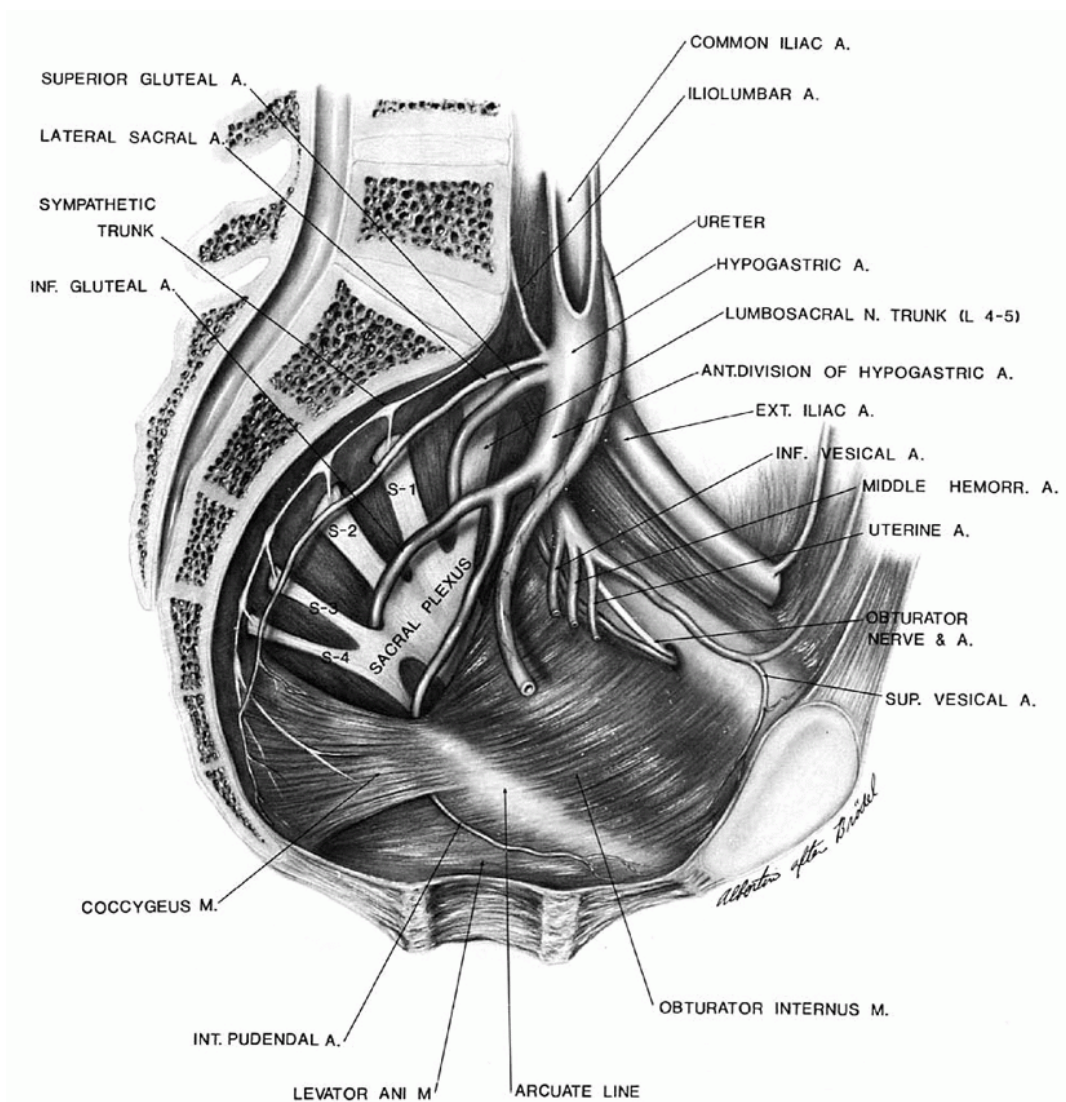


FIGURE 51.11 Anatomy of the arterial blood supply to the female pelvis showing relations of pelvic musculature, divisions of hypogastric artery, and lumbosacral and sacral nerve plexuses. Note that the anterior division of the hypogastric artery provides the blood supply to the pelvic viscera.

The external iliac vein emerges from beneath the inguinal ligament, where it courses along the lateral pelvic brim on the medial side of the artery until it reaches the proximal segment. Here, the vein passes directly beneath the artery at the bifurcation of the common iliac artery and then passes along the lateral side of the upper half of the artery. It then joins the left common iliac vein to become the inferior vena cava at the fifth lumbar vertebra. In dissecting the lymph nodes along the external iliac vessels, these anatomic landmarks are important to avoid trauma to the wall of the vein as it deviates from the medial to the lateral side of the arterial tree.

The hypogastric artery provides the major blood supply to the pelvic viscera. For descriptive purposes, it is conveniently divided into an anterior and a posterior division. The important branches of the hypogastric artery are shown in [Figures 51.11](#) and [51.12](#).

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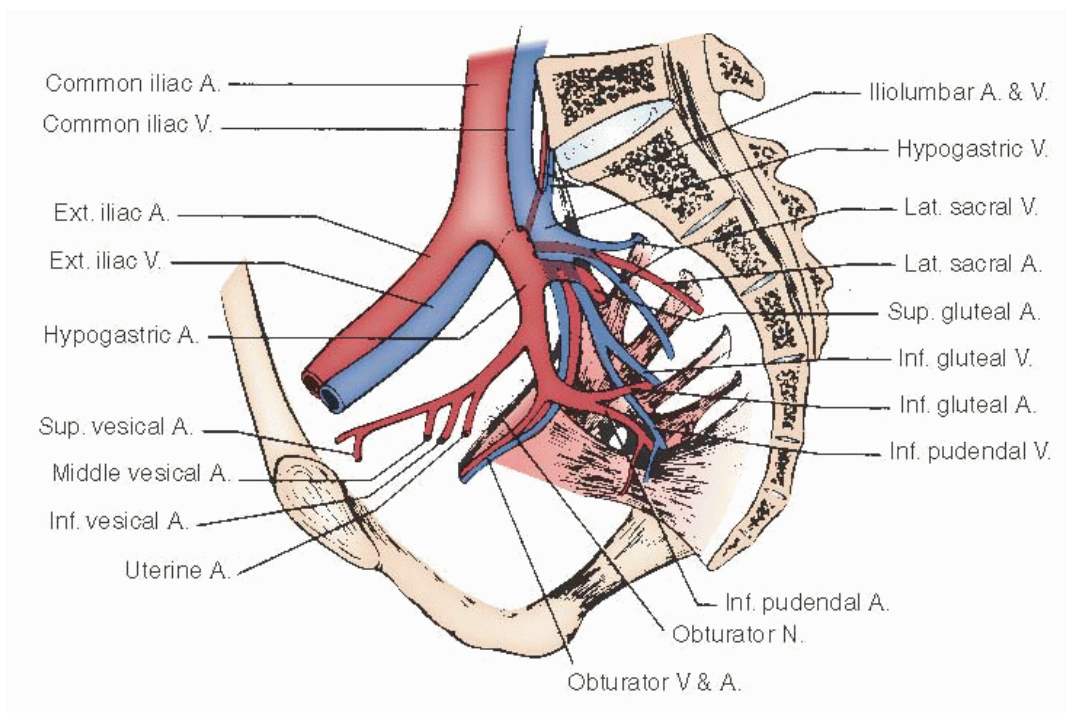


FIGURE 51.12 Anatomy of hypogastric vein. (From Thompson JD. Extensive hysterectomy and bilateral pelvic lymphadenectomy. In: Coppleston M, ed. *Gynecologic oncology*, 2nd ed. New York, NY: Churchill Livingstone, 1992, with permission.)

A fairly consistent arterial branch to the ureter arises from the hypogastric artery near the common iliac bifurcation. This vessel passes medially to the ureter and should be preserved, if possible, during the dissection of the hypogastric vessels. The posterior division of the hypogastric artery continues beneath the coccygeus muscle through the ischiorectal fossa, where it becomes the internal pudendal artery to supply the perineum and vulva.

The major blood supply to the pelvic viscera is derived from the anterior division of the hypogastric artery. [Figure 51.11](#) shows the anterior division, which gives off the uterine artery before continuing along the posterolateral pelvic wall to supply the superior and inferior vesical branches to the bladder. The anterior division then continues as the obliterated umbilical artery as it passes cephalad along the inferior surface of the rectus muscle to the umbilicus. In dissecting along the hypogastric artery in a caudad direction, the uterine artery is the first vessel encountered; it emanates from the medial side of the vessel. Passing more inferiorly and medially is the middle hemorrhoidal artery, which supplies a major segment of the rectum and communicates with the superior hemorrhoidal (from the inferior mesenteric) and the inferior hemorrhoidal (from the internal pudendal) arteries.

The hypogastric vein and its tributaries course along the pelvic floor and medial side of the artery to drain the pelvis in close relation to the arterial blood supply. Its extensive anatomic variations and its location along the pelvic sidewall and floor place these tortuous, thin-walled veins in a precarious and vulnerable position for trauma during deep dissection of the pelvis. As shown in [Figure 51.12](#), the delicate tributaries of the trunk of the hypogastric vein extend into sacral foramina and pass beneath nerve fibers and muscles within the pelvis, so that their visualization during the dissection of the pelvis frequently is obscured. The continuation of the hypogastric vein, in association with the artery, beneath the coccygeus muscle is a frequent site of bleeding when dissection is undertaken along the pelvic floor. When this occurs, it is difficult to identify the vessel because it retracts beneath the margins of the muscle.

The profuse collateral blood supply to the ureter is an important anatomic safeguard that protects its pelvic segment from ischemic necrosis as a result of radical hysterectomy ([Fig. 51.13](#)). The ureter has the advantage of a multiple-source blood supply. This favorable collateral circulation permits interruption of small arteries and veins deep in the pelvis during extensive dissection of the base of the broad ligament without producing a significant incidence of ischemic necrosis and fistula formation. The freely anastomosing arterial and venous network that courses along the longitudinal surface of the ureter in its adventitial layer is supplied in its superior segment by branches from the renal and ovarian arteries. The middle segment of the ureter derives its blood supply directly from aortic branches and from a vessel from the common iliac artery. As the ureter enters the pelvis and courses along the lateral pelvic wall, it receives arterial branches from the uterine, vaginal, middle hemorrhoidal, and vesical arteries. As it approaches the trigone of the bladder, it has a rich arteriovenous collateral circulation from the arterial branches to the vagina and base of the bladder. Protection of this important vascular network is important for the integrity of the terminal ureter during extensive dissection of the cardinal ligament. Preservation of the lateral aspect of the posterior segment of the vesicouterine ligament has been





recommended to ensure adequate vascularity to the terminal segment of the ureter, but we have encountered no difficulty in removing this tissue and have no hesitation in doing so to enhance the adequacy of the central dissection.

Lymphatic Anatomy

The lymphatic drainage of the pelvis follows the course of the arterial and venous blood supply. Although there are multiple variations in the lymphatic anatomy of the pelvis, in general, lateral, superior, medial, and inferior lymph nodes and communicating lymphatic channels surround the common iliac, external iliac, and hypogastric vessels. One of the important pathways of the pelvic nodes and thin-walled lymphatics that drain the upper vagina, cervix, and uterus courses along the posterior aspect of the endopelvic fascia. Here, the pelvic nodes pass through the uterosacral ligament area and terminate in lymph nodes along the lateral aspect of the sacrum. These nodes communicate freely with lymphatic channels from the bifurcation of the common iliac artery near the lateral sacral and ischiosacral fossae. These can be difficult nodes to resect because they are closely attached to the thin-walled tributaries of the hypogastric vein. In dissecting the nodes from the (Print pagebreak 1212) bifurcation of the common iliac vessels, care must be taken to avoid injury to the hypogastric vein, which extends from beneath the artery on the medial side in this area.

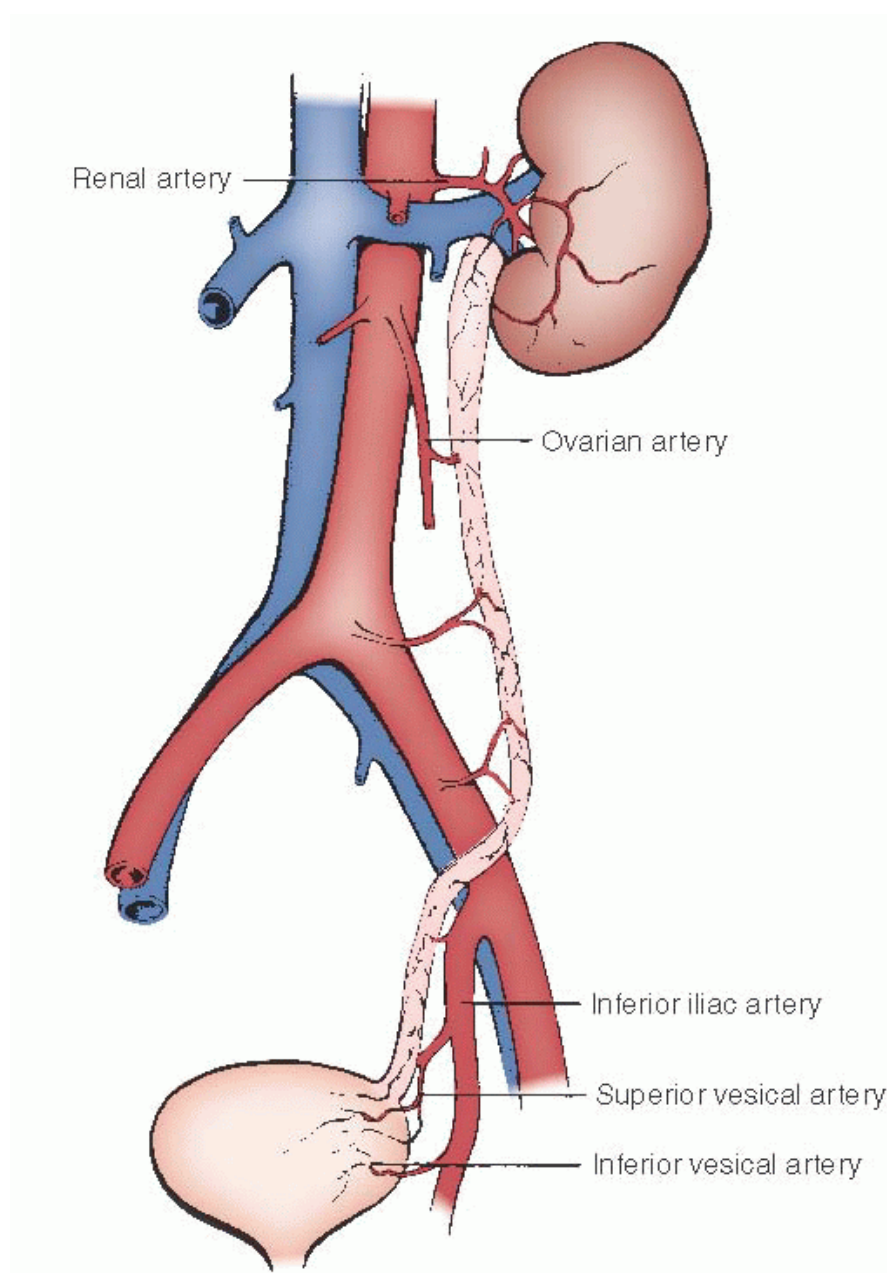


FIGURE 51.13 Blood supply of the ureter showing multiple sources of collateral arterial circulation.

The most direct lymphatic drainage of the cervix and upper vagina is through the lateral parametrium (cardinal ligament) to the hypogastric and obturator lymphatics. Because of the presence of obscure obturator veins and multiple venous tributaries from the hypogastric vein along the pelvic floor, the obturator dissection can be associated with troublesome venous bleeding. Injury also can occur to the obturator nerve, which arises from the anterior division of the second, third, and fourth lumbar nerves; enters the pelvis





through the psoas muscle; and runs along the lateral pelvic wall in the obturator fossa to exit the pelvis through the obturator foramen along with the obturator vessels. It is a motor nerve to the adductor muscles of the thigh and is the only motor nerve that arises from the lumbar plexus without innervating any of the pelvic structures. Damage to the obturator nerve produces not only motor impairment to the adductor muscles but also sensory loss along the medial aspect of the thigh ([Fig. 51.14](#)). Deep dissection posterior to the obturator nerve can be complicated by bleeding from the tributaries of the hypogastric and obturator veins, so dissection in this area must be done with great care, using clips or vessel sealers on the small vessels and compression for troublesome venous bleeding.

Reiffenstuhl, in his classic study of the lymphatics of the female genital organs, described efferent lymph channels from the cervix to the interiliac lymph nodes, the lateral and medial external iliac lymph nodes, the lateral and medial common iliac lymph nodes, the sacral lymph nodes, the subaortic lymph nodes, the aortic lymph nodes, the superior gluteal lymph nodes, the inferior gluteal lymph nodes, and the rectal lymph nodes. Of these, the inferior gluteal nodes are not technically possible to remove with the standard approach. This is because the nodes lie around the ischial spine in proximity to the inferior gluteal artery and pudendal artery and nerve. An imposing network of veins also surrounds the inferior gluteal nodes. They are thin walled, easy to damage, difficult to expose, and difficult to control when damaged. Reiffenstuhl's concepts of the lymphatic drainage of the cervix are partially shown in [Figure 51.15](#).

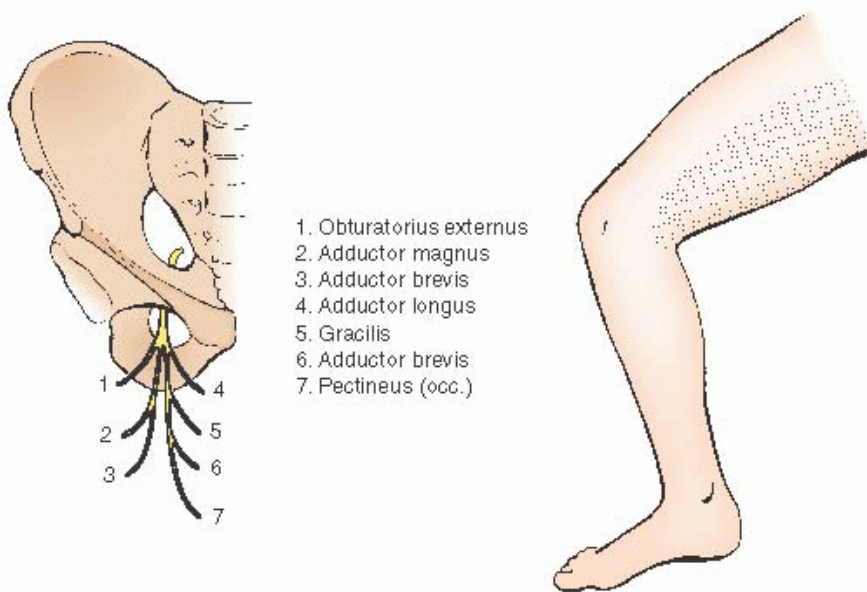


FIGURE 51.14 Obturator nerve (L2 through L4): motor and sensory innervation.

Sentinel lymph node studies in women with cervical cancer are also adding greatly to our knowledge of the lymphatic drainage in vivo ([Fig. 51.16A](#)), and identification of SLNs with blue dye ([Fig. 51.16B](#)), fluorescent indocyanine green (ICG) ([Fig. 51.16C](#)), and technetium injections is feasible, with very low morbidity. These SLNs can be submitted for ultrastaging with immunohistochemistry staining and may help in the postoperative management of cases. Further evaluation and validation of SLN techniques is leading many investigators to recommend the routine use of SLN with pelvic nodal dissection and even consider an SLN algorithm as a comprehensive strategy to evaluate nodal metastasis. Recent studies have strongly suggested that SLN identification can potentially replace complete pelvic lymphadenectomy in select early-stage (I) cervical cancer. The SLN algorithm may help reduce the total operative time as well as some perioperative complications and long-term complications, such as postoperative leg lymphedema, which is occasionally seen in patients undergoing pelvic lymphadenectomy. The most common injection sites for SLN mapping are shown in [Figure 51.16D](#).

EVOLUTION OF THE CLASSIFICATION SYSTEMS OF RADICAL HYSTERECTOMY AND PELVIC LYMPHADENECTOMY

There are several variations of hysterectomy used in the management of cervical carcinoma. The description of the five classes of hysterectomy by Piver and colleagues has found general acceptance and was used for many years. The first three classes are used in the primary treatment of cervical carcinoma, whereas the last two classes are generally reserved for patients (*Print pagebreak 1213*) with recurrent disease. The class I hysterectomy is a simple extrafascial total hysterectomy. It is used as primary treatment for stage IA1 disease and after concurrent chemotherapy and radiation therapy for stage IB2 and bulky stage **IIA** cervical carcinoma. The class II hysterectomy ([Fig. 51.8](#)), also known as a modified radical hysterectomy, removes a more generous vaginal cuff, ligates the





uterine artery on the medial side of the ureter (but does not dissect the ureter from the vesicouterine ligament), and removes the inner one third to one half of the cardinal ligament. As previously stated, some authors recommend the performance of the class II hysterectomy for stage IA2 cervical carcinoma. The class **III** operation is the classic Meigs procedure, with removal of all of the parametrium and paravaginal tissue in addition to the pelvic lymph nodes ([Fig. 51.8](#)). A more extensive procedure is performed in the class IV radical hysterectomy, in which the ureter is completely dissected from the cardinal and vesicouterine ligaments, the superior vesical artery is sacrificed, and three fourths of the vagina is removed, as well as the uterus and parametria, along with a complete lymphadenectomy. A far more extensive procedure is done with the class V radical hysterectomy, in which the terminal ureter or a segment of the bladder or rectum is removed along with the uterus, parametria, adnexa, and pelvic lymph nodes.

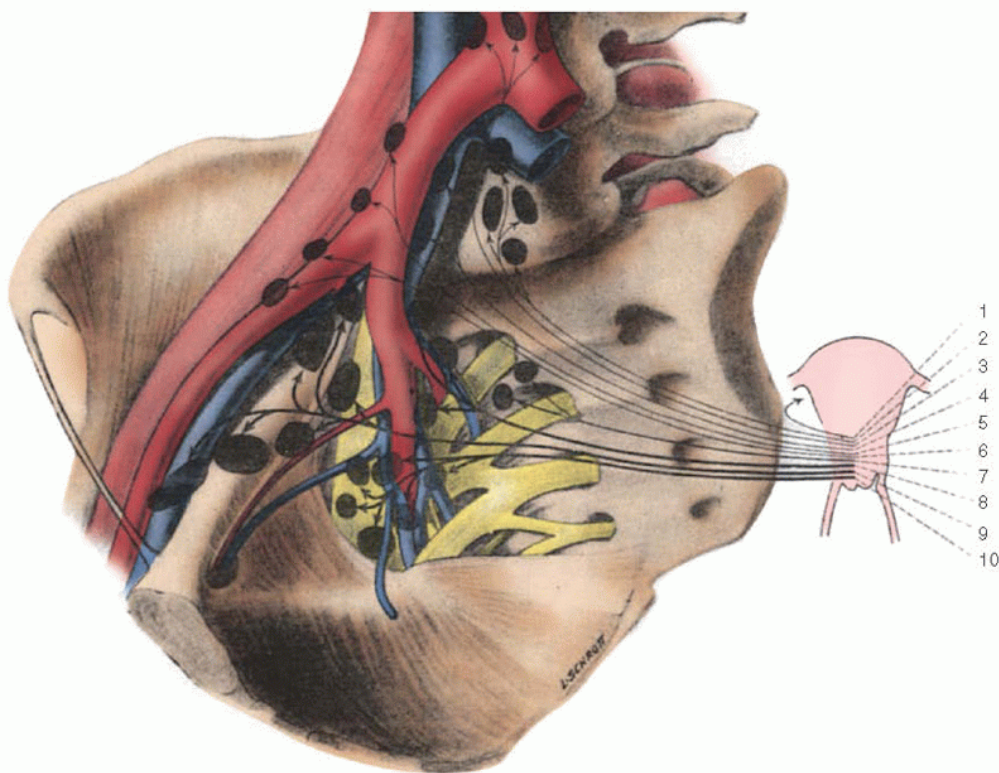


FIGURE 51.15 The regional lymph node stations of the uterine cervix. Channels 8, 9, and 10 (indicated by especially heavy lines) lead to those regional lymph node stations most frequently reached by the efferent lymph vessels of the cervix. Nonetheless, it is necessary to remember that carcinoma cells also can reach the pelvic lymph nodes by way of channels 1 through 7, without previous interruption, to (1) rectal, (2) subaortic (promontorial), (3) aortic, (4) medial common iliac, (5) lateral common iliac, (6) lateral external iliac, (7) sacral, (8) superior gluteal, (9) interiliac, and (10) inferior gluteal lymph nodes. (From Reiffenstahl G. *The lymphatics of the female genital organs*. Philadelphia, PA: JB Lippincott, 1964, with permission.)

Although many techniques emphasize a more or less extensive dissection in one phase of the operation or another, the management of the parametria and the dissection of the pelvic lymph nodes appear relatively uniform. Because the most serious complication of this procedure is related to ureteral fistulae and stenosis, many modifications have been undertaken to ensure an adequate blood supply to the terminal ureter. We agree that the terminal ureter must have a good blood supply and believe that this can be accomplished without jeopardizing the adequacy of the central dissection. The classic radical hysterectomy with wide resection of the parametrium, dissection of the terminal ureter from the vesicouterine ligament, and wide resection of the uterosacral ligaments, upper 2 to 3 cm of vagina, and paravaginal tissues, along with a thorough pelvic lymphadenectomy, is the traditional procedure that is used in our institution.

The major focus of the operation is the adequacy of the central dissection. The central cervical tumor must be removed with an adequate margin of uninvolved normal tissue around it. This is the most crucial point in the success of the operation and has been emphasized by many of the famous pelvic surgeons of former years, especially Parsons and Navratil. The central dissection can be facilitated by developing the pelvic spaces and using proper planes for dissection. Correct (*Print pagebreak 1214*) dissection along natural rather than artificial connective tissue planes and correct development of the pelvic spaces (paravesical, pararectal, vesicocervical, and rectovaginal) avoid unnecessary injury to pelvic vessels, keep blood loss to a minimum, and facilitate an adequate central dissection ([Fig. 51.17](#)). The central dissection also is facilitated by a complete removal of the contents of the obturator fossa (except the obturator nerve) so that branches of the hypogastric artery and vein in the cardinal ligament are clearly visible and can be dissected away from their attachments to the lateral pelvic sidewall.



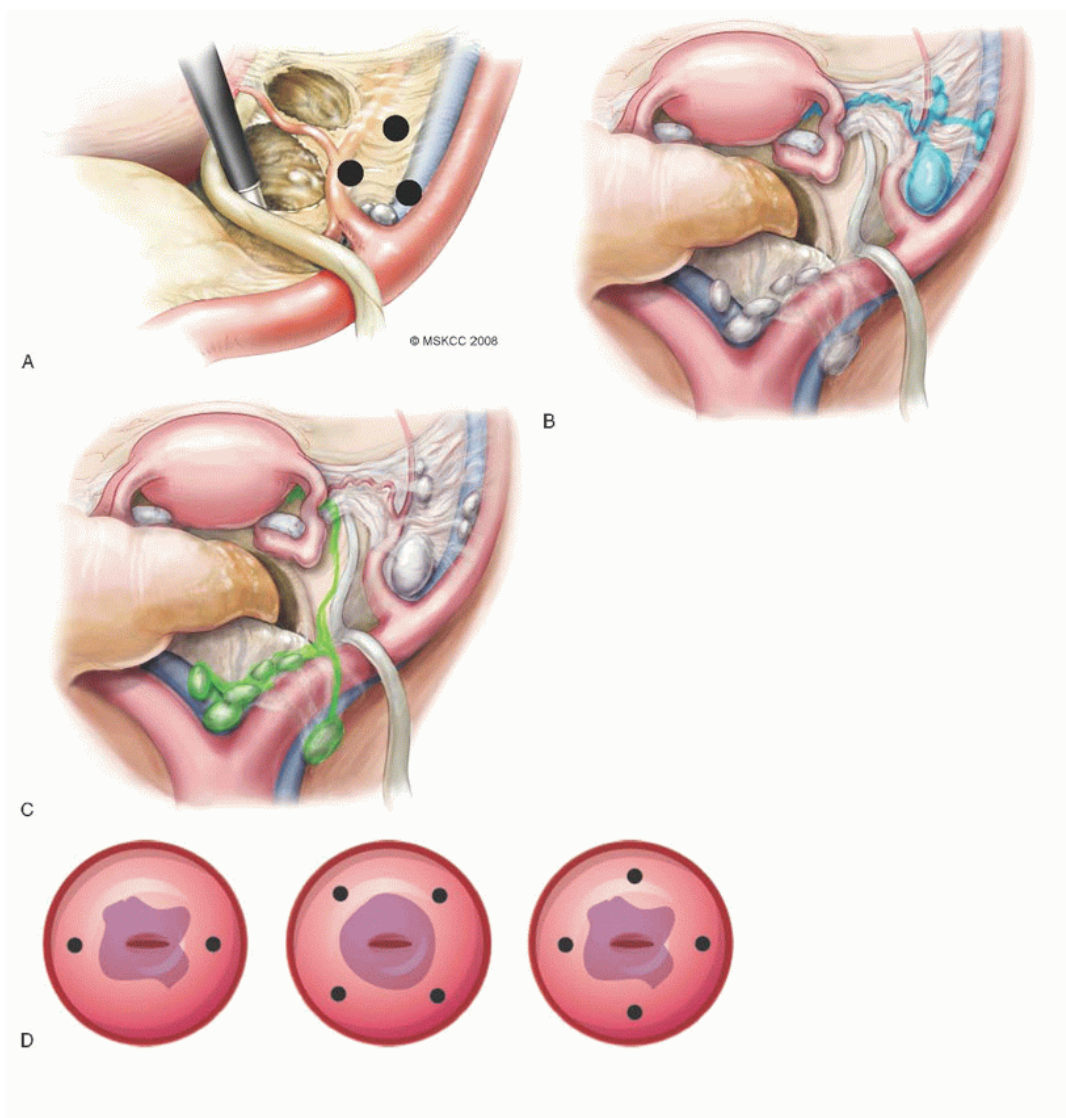


FIGURE 51.16 **A:** Most common sites of involved nodes in women with cervical cancer. **B:** Following a cervical injection of dye, the most common location of SLN is medial to the external iliac, ventral to the hypogastric, and superior part of the obturator nodes. **C:** Less common SLN drainage and location. If the lymphatic trunks are following the mesoureter look for the SLN in the common iliac presacral region. **D:** This picture demonstrated the most common injection sites for cervical neoplasia. Reproduced with permission from Memorial Sloan Kettering Cancer Center.

The importance of an adequate central dissection also was emphasized by Girardi and coworkers. By studying surgical specimens processed according to the giant-section technique of Burghardt and Pickel, parametrial lymph nodes were found in 280 (78%) of the 359 surgical specimens from radical hysterectomies. Metastases to parametrial nodes were found in 63 (22.5%) of these 280 specimens. The lymphatic drainage from the cervix to the pelvic lymph nodes runs through the parametrium, and deposits of tumor often are found there. An adequate central dissection must include removal of a wide margin of parametrial tissue around the central tumor and total removal of the parametria from the bladder, the rectum, and the lateral pelvic wall because positive lymph nodes can be found in the lateral as well as medial parametrium.

(Print pagebreak 1215)



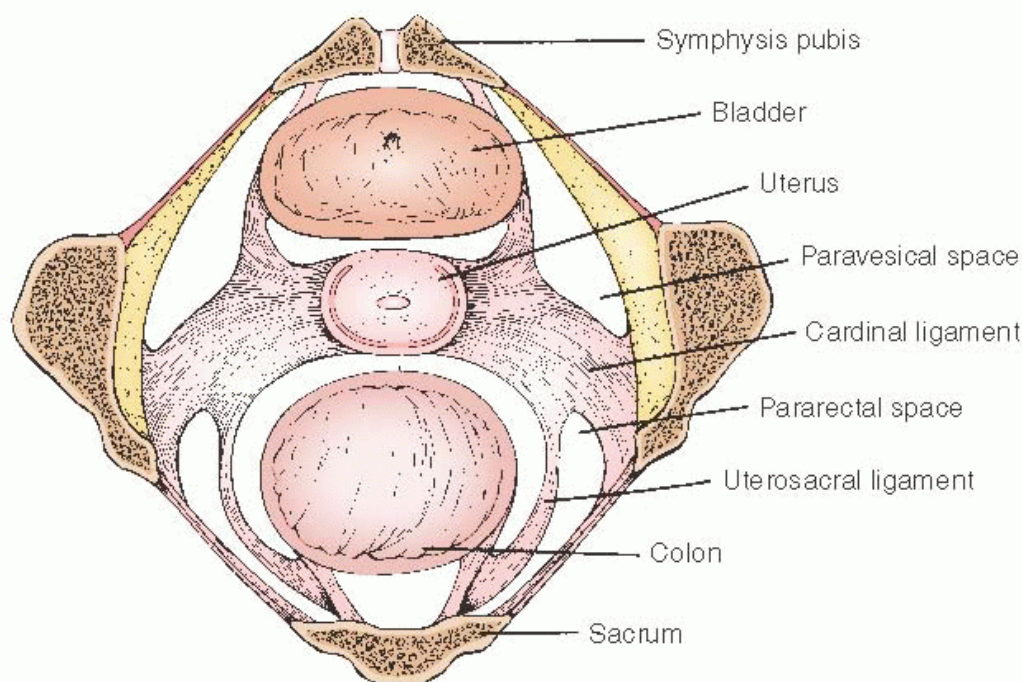


FIGURE 51.17 Cross section of pelvis showing paravesical and pararectal space. The base of the broad ligament (cardinal ligament) extends to the lateral pelvic wall and contains the major lymphatics draining the cervix.

When a large vaginal cuff must be removed because of a bulky cervical tumor or involvement of adjacent vaginal mucosa, starting the operation from below may facilitate the central dissection. Sometimes, a bulky lesion is excised and fulgurated transvaginally. The formation of the vaginal cuff is done in a manner similar to that in the Schauta-Amreich procedure. The vaginal incision is made around the entire circumference of the vagina, mobilizing the vaginal cuff from paravaginal tissue. Further dissection into the paravesical space, vesicocervical space, and rectovaginal space from below may be easier than from above.

Superior to the midcommon iliac arteries and in the paraaortic region, lymph nodes are sampled in selected patients (usually stage IB1 and IIA). A special effort is made to remove any nodes that look or feel suspicious. The paraaortic lymph nodes then are sent for frozen section analysis. Approximately 5% to 10% of stage IB patients have paraaortic lymph node metastasis. Metastasis to the paraaortic lymph nodes is considered by many gynecologic oncologists as a contraindication to radical hysterectomy. These patients are currently being treated with extended-field radiation therapy with concurrent chemotherapy.

In recent years, Querlu and Morrow suggested a modernization of the classic classification system, with a main emphasis on the role of a nerve-sparing radical hysterectomy (type C1) and on three-dimensional topography of radical pelvic surgery. Simply put, a type B resection is equivalent to a class II hysterectomy, a type C1 resection is equivalent to a class III hysterectomy with nerve sparing, and a class C2 hysterectomy is equivalent to a more radical class III operation with disregard to hypogastric and pelvic splanchnic nerves.

RADICAL ABDOMINAL HYSTERECTOMY SURGICAL TECHNIQUE

Preoperative Evaluation and Preparation

After the initial history and physical examination have indicated the possibility of primary treatment with radical hysterectomy and pelvic lymphadenectomy, the usual preoperative evaluation common before any extensive operation is indicated. We also recommend a chest x-ray to screen for cardiac or pulmonary disease as well as the very low risk of pulmonary metastases.

Contrary to the frequent practice of doing all possible tests on every patient, it is our practice to be selective and to do only those tests and procedures that are expected to yield useful information. It is not necessary (and indeed may be inappropriate) to subject every patient to a long list of preoperative procedures that are expensive and exhausting and have little, if any, expectation of providing useful information. Indeed, it is most unfortunate when a test or procedure yields questionable or suspicious findings that require one or more additional studies that, after delay, discomfort, and expense, turn out to be negative or even perhaps nondiagnostic. Good judgment from an experienced clinician is usually the most helpful.





A young, healthy patient with a small cervical lesion requires an admission history and physical examination, chest radiograph and routine laboratory studies, and anesthesia consultation. If the patient is older, has medical complications, or has a larger or undifferentiated cervical lesion, the preoperative workup and preparation may be more involved and thorough. Although an intravenous pyelogram provides good visualization of the course and number of ureters, if radiologic evaluation of the abdomen and pelvis is being considered, most surgeons obtain a CT scan of the abdomen and pelvis with contrast, which also shows the course and number of ureters and also may provide additional information about nodal or other metastases. However, because of the uncertainty of enlarged nodes on CT scan, patients with clinical stage IB1 disease and enlarged pelvic nodes on CT scan would not make us cancel the surgical approach in favor of radiation therapy. These nodes need to be evaluated further, possibly with a surgical resection, biopsy, or PET scan.

Larger lesions or those more likely to have metastases may be investigated by pelvic and abdominal CT scan or magnetic resonance scans, but we have rarely found those to be helpful in women with small cervical cancers. They may be most helpful when the clinician is undecided regarding whether primary surgery or radiation is the best management option—a clean, normal study may be reassuring that primary surgery is the way to go, whereas suspicious, enlarged nodes in a woman with a 4-cm cervical lesion help make the decision to recommend radiation. Likewise, cystoscopy or proctoscopy is rarely indicated or helpful in the preoperative evaluation of early-stage cervical cancer. As much as possible (*Print pagebreak 1216*) should be done on an outpatient basis before admission to the hospital.

Bowel Preparation

In our institution, patients are asked to start a liquid diet 24 hours before surgery. They also are given a mechanical bowel preparation if significant peritoneal adhesions are anticipated or there is a history of previous major pelvic surgery or radiation. An intestinal tube for suction is not necessary.

Positioning and Incision

Multiple approaches to performing a radical abdominal hysterectomy and bilateral pelvic lymphadenectomy have been described. The traditional transperitoneal approach has been used in our institution for many years, with satisfactory results. The transverse Maylard or Cherney incision is used by some, whereas others prefer midline incisions. Orr and Scribner have reported shorter hospital stays when a Pfannenstiel incision is used. Currie has presented and published a technique using a transverse cosmetic incision with vertical fascial entry for selected patients.

After anesthesia is induced, some surgeons prefer that the patient be placed comfortably in stirrups, with the buttocks brought to the edge of the “broken” table. Pneumatic compression devices are placed on both lower extremities, and the knees are separated approximately 90 degrees. The thighs are elevated only 15 to 20 degrees relative to the abdomen. Care is taken to avoid pressure on the peroneal nerves in the legs. Proponents of this position claim several advantages. There is less strain on the patient's lumbosacral spine when the thighs are slightly flexed. This is especially important for patients with lumbosacral back problems. It is possible to have a second assistant stand at the foot of the table between the patient's legs. His or her participation in the operation is greatly facilitated by being closer to the operative field. Finally, in this position, the urethral orifice, vaginal introitus, and anal orifice are all available for instrumentation in case this is necessary to clarify anatomy.

After the patient is positioned on the operating table, a careful rectovaginal-abdominal pelvic examination is done. This can be followed by cystoscopy or proctosigmoidoscopy if desired. If hair needs to be removed, it is preferable to use an electric hair trimmer rather than a razor. The skin is prepared from the rib margin to the midthigh, with special attention given to the umbilicus, perineum, and vagina. The patient is draped, a transurethral Foley catheter is inserted into the bladder, and the operation is begun. If an SLN injection is planned, the injection is done at the time of exam under anesthesia just before the patient is prepped and draped.

When operating abdominally, the exposure achieved depends on the choice of incision, the method of retracting, the placement and intensity of overhead lights, and the participation of willing and skillful assistants. Suction should be available to keep the field dry. Dry sponges are likely more traumatic to delicate serosal surfaces and other tissues. It usually is possible (and always desirable) to keep the number of clamps in the operative field to an absolute minimum. If the field is cluttered with clamps, the operator cannot see well to operate. There is sometimes a tendency for gynecologic surgeons to use instruments that are too short. Pedicle clamps, tissue forceps, dissecting scissors, needle holders, and all other instruments must be longer when operating deep in the pelvis and when operating on obese patients. The handles of the instruments must come all the way out and above the level of the incision so that they do not interfere with the operator's vision.

Evaluation at Laparotomy

As stated, the operation is initiated through a low-transverse (Maylard, Cherney, Pfannenstiel) or low midline incision; the same





exploratory strategy should apply if a minimally invasive approach is being utilized. In most patients, the umbilicus identifies the location of the bifurcation of the aorta; therefore, extension of the incision approximately 2 to 3 cm above the umbilicus is recommended for adequate exposure of this area if a lower midline incision is used. The midline incision is protected by a moist pack beneath each arm of the self-retaining retractor to avoid excessive compression of the epigastric vessels that course beneath the rectus muscles. In case of a lengthy operative procedure, the mechanical retractors are released at periodic intervals to improve circulation through the abdominal musculature. The bladder is decompressed by an indwelling catheter throughout the procedure to facilitate exposure and maintain an accurate record of urine output.

Before initiating the pelvic procedure, the abdominal viscera and parietal peritoneum of the abdominal cavity are evaluated meticulously for possible evidence of metastatic tumor. The superior and inferior surfaces of the liver are carefully palpated, as is the region of the celiac plexus. The undersurface of the diaphragm is particularly vulnerable to metastases, especially the right hemidiaphragm, where the paraaortic lymphatics pass from the abdominal cavity into the mediastinum. The mesentery of the large and small bowel and the serosal surface of the bowel along with the omentum should be examined carefully for evidence of metastatic tumor. The kidneys are examined, and the retroperitoneal space along the aorta and vena cava is palpated assiduously because these are the major sites of extrapelvic spread of cervical cancer. It is well known that 15% or more of paraaortic node metastases are occult; therefore, even the most unsuspecting node should be removed and evaluated histologically by frozen section study for possible metastatic tumor. If there is histopathologic evidence of unsuspected, metastatic tumor in a paraaortic lymph node, we generally do not proceed with a radical hysterectomy, and the operation is abandoned. These patients are currently being treated with concurrent chemotherapy and extended-field radiation therapy.

Peritoneal washings for cytologic examination usually are not obtained because the yield is low and the prognostic significance is undetermined.

At this point in the procedure, any adhesions in the pelvis are lysed, and the intestines are placed in the upper abdomen and held there with moist packs. A suitable self-retaining retractor can be used. If Bookwalter, Turner-Warwick, or Balfour retractor is used in a lower midline incision, care must be taken to avoid compression of the femoral nerves by the lateral blades.

An evaluation of the extent of the pelvic tumor is undertaken at this time by examining the course of the lymphatic drainage of the pelvis, which is carefully palpated along the pelvic vessels. When enlarged or clinically suspicious nodes are found, they are removed and immediately sent for frozen section study while further evaluation of the pelvis is undertaken. The paravesical and pararectal spaces are important anatomic landmarks. When developed, they provide an opportunity for thorough exploration of the intervening base of the broad ligament ([Fig. 51.17](#)). Tumor can extend into the base of the broad ligament without detection of anatomic evidence of disease before operation. This step, therefore, is a safeguard in determining the possible extension of tumor beyond the cervix and into the immediate paracervical tissues. When there is evidence of extracervical disease, we may abandon the surgical (*Print pagebreak 1217*) procedure unless there is clear evidence that the disease can be removed cleanly. In either case, full pelvic irradiation is indicated. Certainly, the lateral pelvic wall must be free of tumor. When the central tumor is clearly resectable, we do not hesitate to complete the operation, even if there is evidence of metastatic disease in the pelvic lymph nodes.

A decision must be made about conservation or removal of the tubes and ovaries before the pelvic planes and spaces are developed. If normal ovaries are conserved in premenopausal patients, the tubes usually may be removed. After the round ligaments are clamped, cut, and ligated, the utero-ovarian ligaments and medial fallopian tubes are clamped and doubly ligated. The infundibulopelvic ligaments are carefully mobilized, and the adnexal organs are packed out of the operative field with the intestines.

Development of Paravesical Space

The anterior leaf of the broad ligament forms the roof of the *paravesical space* and blends with the bladder peritoneum medially and the parietal peritoneum laterally. This deep fossa beneath the peritoneal covering is composed of loose connective tissue and fat. It occupies the area between the bladder and the retropubic space medially, with the pelvic sidewall and obturator muscle forming the lateral boundaries. The superior boundary is formed by the cardinal ligament, whereas the floor is composed of the levator ani muscle. After clamping and ligating the round ligament about midway along its course, the anterior leaf of the broad ligament is opened in an inferior direction, passing well into the pelvis before diverting the incision medially to reflect the bladder peritoneum from the lower uterine segment ([Fig. 51.18A](#)). The paravesical space can be entered without difficulty with gentle digital pressure, making certain that the dissection is initiated between the external iliac vein laterally and the obliterated hypogastric artery (lateral umbilical ligament) medially. The dissection is carried all the way down to the levator ani muscle ([Fig. 51.18B](#)). There are no major blood vessels in this potential space, although occasionally, an aberrant obturator vessel emerges from the inferior epigastric artery and courses along the posterior aspect of the pubic bone to the obturator space. With gentle digital dissection, the pelvic floor can be palpated and the posterior aspect of the space can be identified, including the anterior margin of the cardinal ligament.



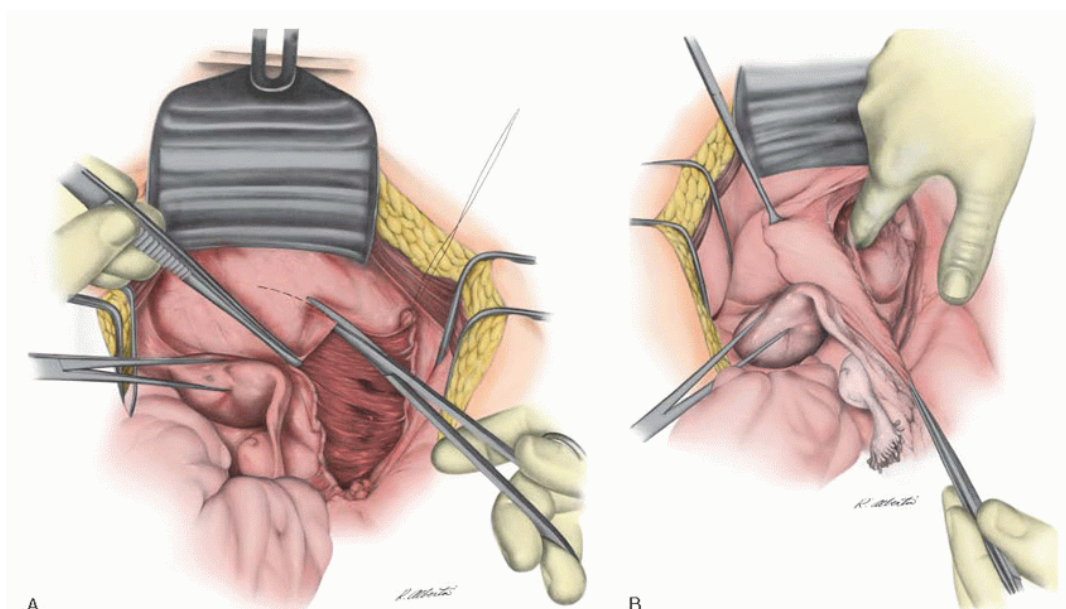


FIGURE 51.18 A: Opening the anterior leaf of the broad ligament after ligation of the right round ligament and infundibulopelvic ligament. **B:** Development of paravesical space.

Development of Pararectal Space

The *pararectal space* lies beneath the pelvic peritoneum and extends between the cardinal ligament laterally and the uterosacral ligament medially. It can be entered by extending the incision in the anterior leaf of the broad ligament in a cephalic direction along the lateral margin of the infundibulopelvic ligament ([Fig. 51.19A](#)). By retracting the infundibulopelvic ligament and displacing the uterus medially, the uterosacral ligament is placed on a stretch, and the pararectal space is widened. Dissection of this space is much more precarious than that of the paravesical space. Unskilled dissection in this area frequently is associated with troublesome bleeding. The medial border of the fossa is bounded by the uterosacral ligament and rectum, and the lateral border is formed superiorly by the piriformis muscle and inferiorly by the levator muscle. The sacrum forms the posterior margin of the space, and the ureter is attached to the peritoneum along the roof of the space before entering the medial aspect of the cardinal ligament. The hypogastric artery and vein are located in the deeper aspect of the pararectal space along the levator ani muscle. (*Print pagebreak 1218*) The cardinal ligament forms the caudal and lateral borders of this important area. Entry into the pararectal space must be made cautiously ([Fig. 51.19A](#)) with medial displacement of the ureter and its attached peritoneum. A point between the ureter, which is attached to the medial leaf of peritoneum, and the hypogastric artery is selected. Blunt dissection should be used in this area, and careful handling of tissue is imperative to avoid unnecessary damage to small veins deep in this fossa. When the examining finger reaches the pelvic floor and levator ani muscle, the fossa narrows, and care must be taken to avoid damage to the lateral sacral and hemorrhoidal vessels. The dissection is carried vertically downward for a short distance. The further development of the space then changes to an inferior and caudad direction lateral to the rectum. If the development of the space is difficult, it should be delayed until a later time in the operation. When the paravesical and pararectal spaces have been dissected ([Fig. 51.19B](#)), the pelvic floor and cardinal ligament easily can be identified and palpated. In the absence (*Print pagebreak 1219*) of demonstrable tumor extension, the case is considered operable, and the lymph node dissection is initiated at this time.



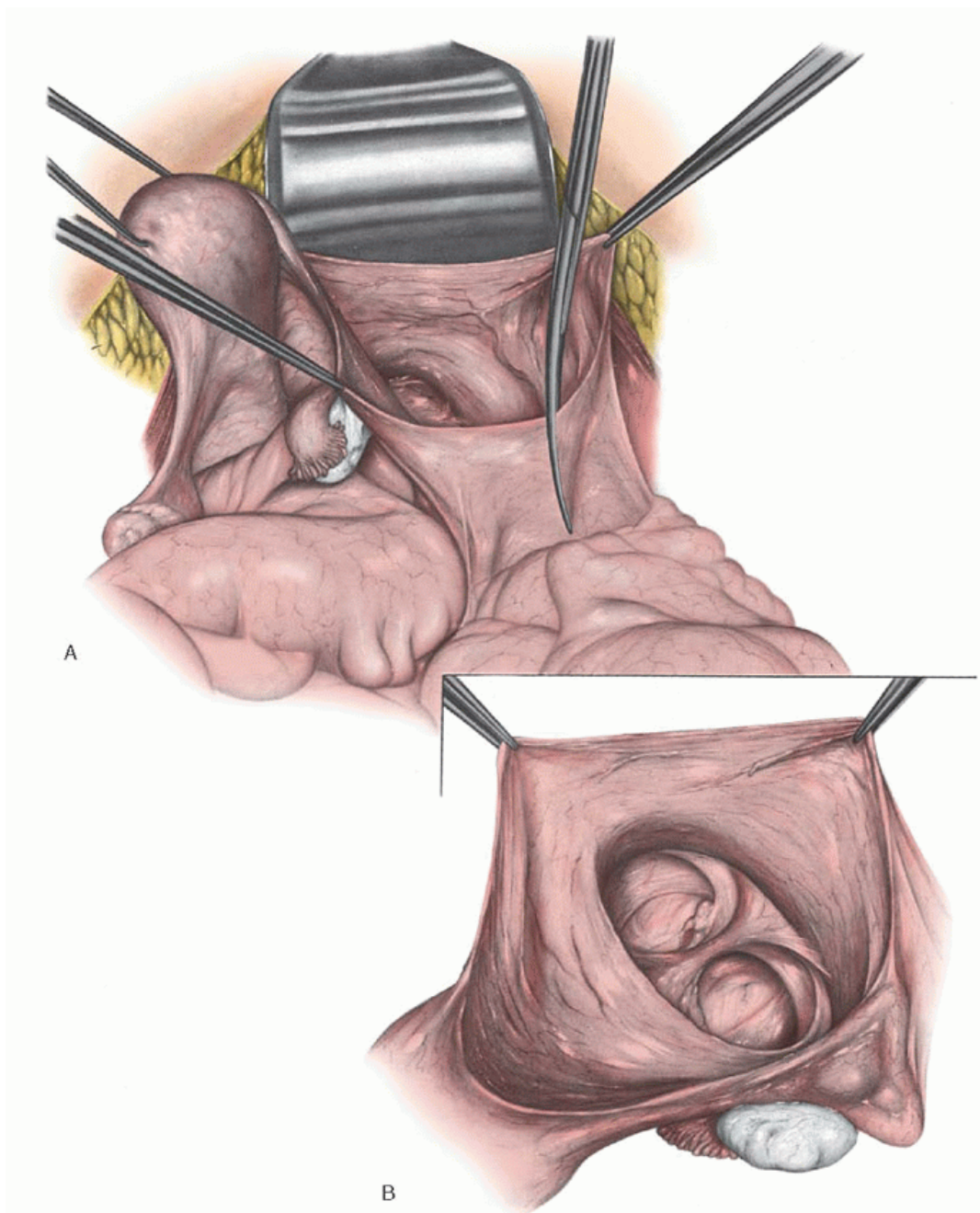


FIGURE 51.19 A: Extending the incision in the anterior leaf of the broad ligament in a cephalic direction along the lateral margin of the right infundibulopelvic ligament. **B:** Paravesical and pararectal fossae, with intervening base of broad ligament attached to pelvic floor and lateral pelvic wall.

Pelvic Lymphadenectomy

If an SLN mapping is planned, the SLNs are removed first. Dissection of the lymphatic tissue along the iliac vessels can begin in the region of the bifurcation of the common iliac artery and extended superiorly to the bifurcation of the aorta and inferiorly to the inguinal ligament and deep circumflex iliac vein, or it can begin at another point along the course of the iliac vessels. The opening of the posterior peritoneal leaf of the broad ligament must be extended to the area of the pelvic brim, where the ureter is easily identified as it enters the pelvis at the bifurcation of the common iliac artery. This dissection is made easier if the infundibulopelvic ligament has been ligated and divided; however, the ligament and ovarian vessels can be retracted medially if the adnexa are preserved. The ovary and tube also can be detached from the uterine corpus and gently tucked beneath the retractor above. In dissecting the presacral area in the angle of the bifurcation of the aorta, care must be taken to avoid bleeding from the middle sacral vessels as well as from the proximal part of the left external iliac vein, which courses through this retroperitoneal space. It is best to occlude the middle sacral vessels with smaller vascular clips as they are identified, and if traumatized, the venous bleeding can be controlled with positive pressure against the sacrum and with vascular clips. The lymphatic tissue along the common iliac vessels is removed by sharp dissection with the points of the Metzenbaum scissors directed upward, while special care is taken to avoid





trauma to the ureter ([Fig. 51.20](#)). The ureter is reflected medially during the dissection of the common iliac vessels and left attached to the parietal peritoneum to maintain its blood supply.

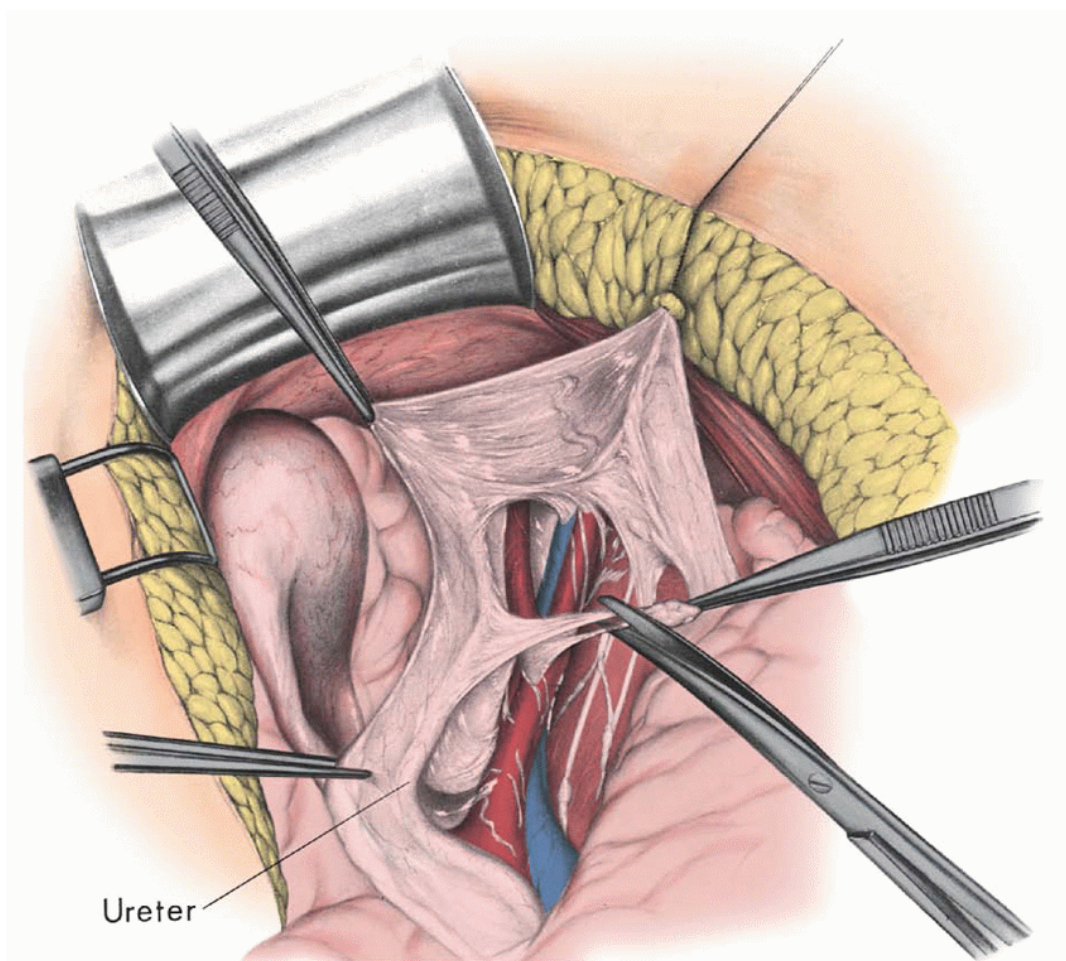


FIGURE 51.20 Pelvic lymphadenectomy with dissection of right common iliac vessels and their branches, including the external iliac and hypogastric arteries and veins. Note attachment of ureter to parietal peritoneum. The genitofemoral nerve courses along the psoas muscle.

It is important to remove the loose areolar tissue and fascial sheath from the iliac vessels; however, to avoid trauma to the intima or wall of the vessels (particularly the veins), the surgeon should not attempt to skeletonize the pelvic vessels to the point of producing a pearl-white vascular tree. If there is tumor in the adventitia of the vessel wall, the patient probably will not be cured by this procedure; consequently, such compulsive surgical efforts produce far more complications than benefits. It is important to rotate the vessels medially and laterally with a vein retractor during the dissection of the common and external iliac trunks to obtain the posterior (*Print pagebreak 1220*) lymphatic chain behind the vessels along the psoas muscle. The genitofemoral nerve, which is seen lateral to the external iliac vessels, should be preserved, if possible, because damage to this peripheral nerve occasionally produces postoperative discomfort in the groin and medial aspect of the thigh.

The external iliac vessels are carefully dissected down to the point where the deep circumflex iliac vein crosses over the external iliac artery. At this point, care must be taken to avoid injury to the inferior epigastric artery and vein, which arise from the anterior and medial side of the iliac vessels and course along the anterior peritoneum onto the lower abdominal wall. Removal of the distal external iliac or circumflex iliac nodes cephalad to the Cloquet node likely increases the risk of leg lymphedema. The surgeon also must be cognizant of the anomalous obturator artery and vein, which can arise from the lower portion of the external iliac or inferior epigastric vessels and course over the pelvic sidewall into the obturator space. If accidentally traumatized, they should be ligated at their point of origin from the artery or vein. To avoid bleeding in the obturator space, these vessels are frequently occluded with small vascular clips as they pass through the obturator space, regardless of their origin. Clips also can be used to occlude the lymphatic channels coming into the pelvis from the leg.

The obturator space is entered by reflecting the external iliac vessels medially away from the psoas muscle and freeing the areolar tissue that lies directly between these vessels and the lateral pelvic wall ([Fig. 51.21A](#)), usually with blunt dissection. Once the space has been entered and the adjacent tissue cleaned from the external iliac vessels, the artery and vein are released and gently retracted laterally with a vein retractor, and the obturator space is clearly exposed. The lymphatic and areolar tissue are dissected from the





obturator space to the region of the pelvic floor, with particular care taken to avoid trauma to the obturator nerve and vessels ([Fig. 51.21B](#)). The dissection is continued by removing all of the nodes below the bifurcation of the iliac vessels, including the hypogastric nodes and the nodes in the obturator fossa. A lymph node may be encountered in the angle formed by the external iliac and hypogastric arteries and must be carefully dissected out, avoiding trauma to the adjacent hypogastric vein.

Retraction of the common iliac artery and vein medially exposes a group of lymph nodes that should be removed carefully. These lymph nodes are the lateral common iliac nodes. There is danger of venous bleeding in this area. When this area has been cleared, the surgeon can see the obturator nerve entering the obturator fossa through the body of the psoas muscle. The nerve roots of the lumbosacral plexus also are exposed. Particular care must be exercised in the dissection of the lateral sacral and sacroiliac plexus, just medial to the hypogastric artery and vein, near their origin. The rich arcade of small arteries and veins increases the risk of bleeding in this area. When the vessels retract into the sacral foramen, control of bleeding becomes difficult.

The obturator artery can be identified as it courses along the lateral pelvic wall adjacent to the obturator nerve. The nerve, artery, and vein advance toward the obturator foramen, through which they leave the pelvis. Care must be taken to avoid trauma to all of the structures, particularly the obturator veins, which have a rich anastomotic network against the lateral pelvic wall and communicate freely with the adjacent hypogastric veins. It is best to ligate or clip the obturator vessels, but if uncontrolled bleeding occurs in this area, hemostasis is best obtained by packing the space tightly with a hot pack and providing adequate time for a fibrin clot to develop. If excessive bleeding occurs on one side of the pelvis, dissection can continue on the opposite side in the interim after pressure packing.

Dissection of Hypogastric Artery, Uterine Artery, Bladder, and Ureter

The hypogastric artery is dissected with identification of the visceral branches of the anterior trunk, which include the uterine; superior, middle, and inferior vesical; vaginal; and middle hemorrhoidal arteries. The anterior division of the hypogastric artery continues along the paravesical fossa to become the obliterated lateral umbilical ligament beneath the anterior abdominal wall. If the superior vesical artery is damaged, it can be ligated without serious compromise to the blood supply of the bladder. At this point, we ligate the uterine artery at its origin from the hypogastric artery. Some authors believe that a more adequate central dissection is achieved by ligating the anterior division of the hypogastric artery just distal to the point of origin of its posterior division rather than ligating the uterine artery individually. Whichever vessel is chosen, after double ligation, the distal branches traversing the cardinal ligament are removed with the specimen. No attempt is made to remove the hypogastric vein. The other, adjacent veins should be ligated to avoid brisk bleeding in this area.

The bladder then is reflected off the lower uterine segment by incising the bladder peritoneum from its attachment to the uterus. The fascial adhesions of the base of the bladder are released from the cervix and upper vagina by electrocautery or sharp scissors dissection, and the vesicocervical space is developed inferiorly and laterally. The ureter tunnels between the anterior fascial bundles of the base of the broad ligament, commonly called the vesicouterine ligament. This fascial tunnel is carefully opened by sliding the Metzenbaum scissors or an Adson right angle clamp, with concave surface pointed upward, along the anterior and medial surface of the ureter, and by gently spreading the blades, as shown in [Figure 51.22A](#). The uterine artery and vein course along the fascial roof of this ligament. As shown in [Figure 51.22B](#), the anterior sheath of the vesicouterine ligament is opened by doubly clamping and incising this tissue. Each of the fascial bundles is suture ligated for control of bleeding, and the ureter is dissected free of its attachment to the posterior leaf of the vesicouterine ligament. As with the pelvic vessels, care must be taken to prevent damage to the adventitia and muscular wall of the ureter, which contain nutrient vessels from the collateral circulation. In the event that the blood supply to the ureter is compromised by thrombosis or trauma to the veins, fistula formation is a serious and frequent complication. The ureter is gently retracted with an umbilical tape or vein retractor. If forceps are used to handle the ureter, they should gently grasp only the adventitia.

Dissection of Cardinal Ligament

The base of the broad ligament (the cardinal ligament) then can be excised from its attachment at the lateral pelvic wall. The technique of clamping and ligating the vascular cardinal ligament varies, depending on the circumstances. Sometimes, part of the ligament can be included in a single clamp. Sometimes, it is better to ligate or clip individual vessels. The ligament is excised with sharp scissors dissection and ligated with 2-0 delayed absorbable suture. A series of clamps are placed until the dissection is completed to the pelvic floor and along the paravaginal tissues ([Fig. 51.23](#)). If serious bleeding occurs in this region owing to trauma to the pelvic floor veins, hemostatic control is best obtained by firm packing of the pelvis and shifting the dissection temporarily to the opposite side.

(Print pagebreak 1221)



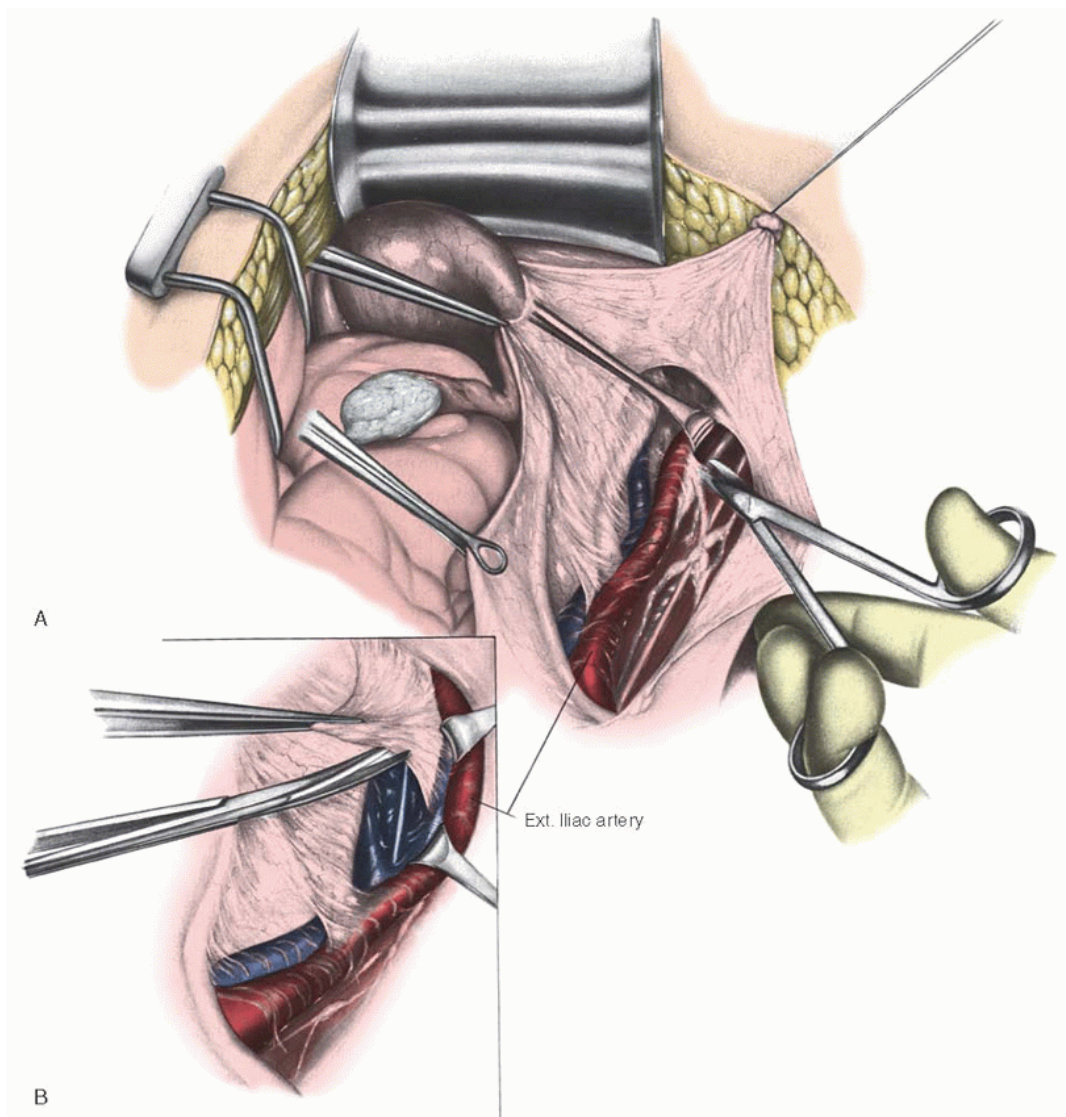


FIGURE 51.21 **A:** Entry into obturator space by medial reflection of external iliac vessels. **B:** Dissection of obturator fossa, demonstrating obturator nerve with areolar tissue attached superiorly to external iliac vessels.

The uterosacral ligaments originate from a posterolateral position on the cervix, where they are thickest, and run posteriorly to the anterolateral aspect of the rectum. As the ligaments approach the rectum, they broaden so that they have a wider attachment to the rectum than to the cervix. The uterosacral ligaments are stretched by sharply drawing the uterus forward. The peritoneal reflection of the cul-de-sac of Douglas then is incised, leaving a small segment of peritoneum attached to the anterior surface of the rectum. Care must be taken to avoid injury to the ureters, which are attached to the peritoneum just lateral to the uterosacral ligament ([Fig. 51.24A](#)). The rectovaginal space is opened by sharp scissors dissection and deepened by blunt and sharp dissection ([Fig. 51.24B](#)). This procedure separates the posterior reflection of the endopelvic fascia from the lateral wall of the rectum, which includes the more superficial uterosacral ligaments. The entire fascial bundle of the uterosacral ligament is identified, clamped as far posteriorly and close to the anterior rectal wall as possible, and cut and ligated ([Fig. 51.24C](#)). No attempt is made to divide the attachments to the sacrum. Using modern vessel-sealing devices to transect both the cardinal and uterosacral ligaments is advocated by some authors to significantly reduce operating time and blood loss, without any adverse effects on complication or tumor recurrence (*Print pagebreak 1222*) rates. Continuation of this plane of dissection along the posterior endopelvic fascia frees the posterior aspect of the cervix from the pelvic floor. Trimbos and colleagues have described a “nerve-sparing” radical hysterectomy that involves a less radical dissection of the uterosacral ligament, which reduces the incidence of bladder dysfunction, without compromising cure rates.



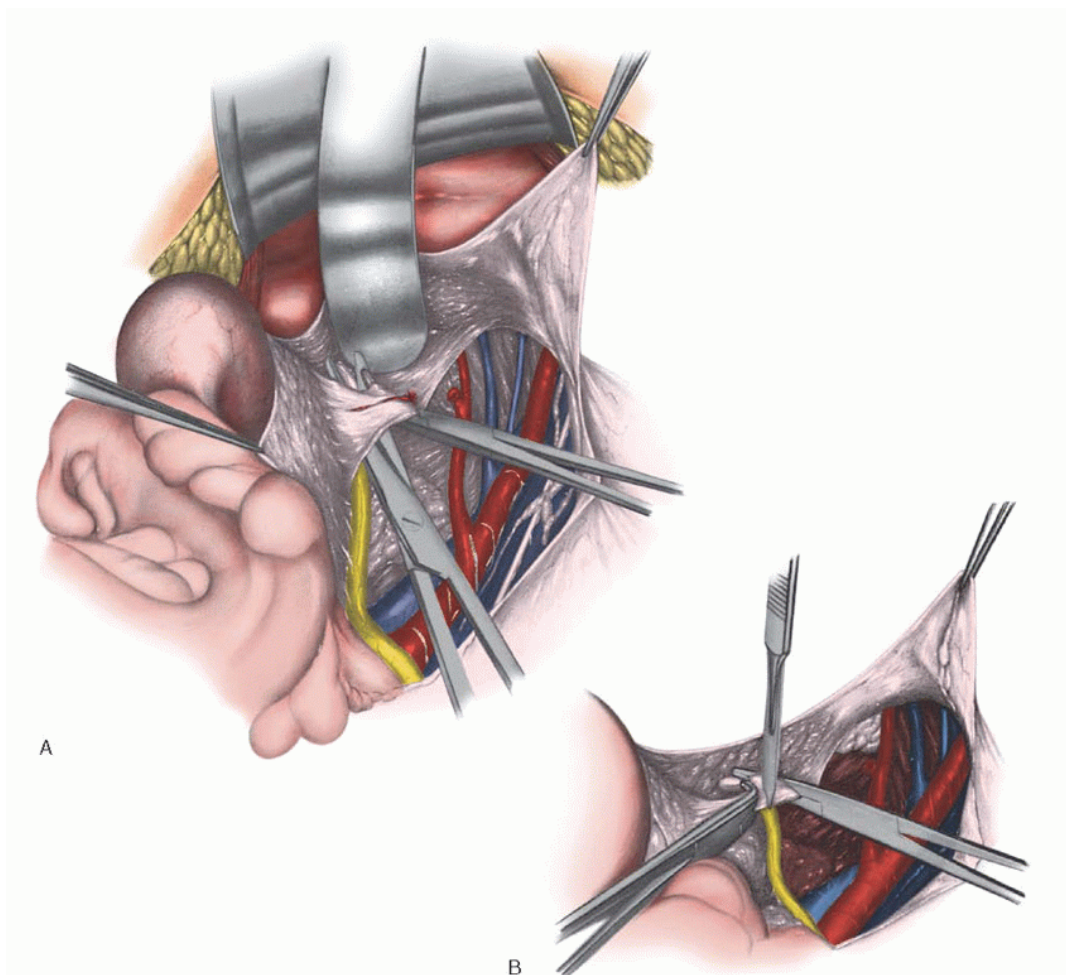


FIGURE 51.22 A: Metzenbaum scissors inserted above the ureter in the vesicouterine ligament or ureteral tunnel of the broad ligament. Note ligated uterine artery in anterior fascial sheath of tunnel. **B:** Roof of tunnel is opened between clamps.

It is important to dissect the paravaginal fascia to obtain all of the microlymphatic channels that communicate between the cervix and upper vagina ([Fig. 51.25](#)). The bladder then is dissected further from the upper portion of the vagina by sharp and blunt dissection, making certain to avoid trauma to the blood supply of this organ. It is important, therefore, that sharp dissection, rather than blunt trauma, be used to free the base of the bladder from the anterior vagina to avoid forceful tearing of the blood vessels and musculature of the bladder. When the specimen is ready to be removed, a long right-angled Wertheim clamp is placed across the vagina below the cervix (not shown) to avoid gross spillage of tumor cells into the pelvis. The specimen then is removed by dividing the vagina above clamps placed on the lateral vaginal angles ([Fig. 51.26](#)).

Closure

The vaginal angles are suture ligated separately to secure hemostasis, and then the remaining cuff is closed in an anteroposterior direction using a continuous or interrupted 2-0 or no. 0 absorbable suture. No additional attempt is made to support the vaginal vault because all of the fascial support of the uterus and vagina has been removed. The remaining vagina, which has been shortened by about 2 to 3 cm, is well supported by its attachments to the levator ani muscles and urogenital diaphragm and mainly by the effects of postoperative fibrosis during the healing phase.

At the end of the procedure, some surgeons place suction catheters in the obturator fossae and along the lateral pelvic walls and bring them out through stab wounds in the lower (*Print pagebreak 1223*) abdomen. After the abdomen is closed, these catheters are connected to intermittent, low-suction drainage units. Traditionally, these drains were thought to be effective in preventing pelvic infection and fistula and lymphocyst formation. However, recent retrospective and prospective studies have demonstrated that the incidence of these complications is minimal and the same whether or not drains are used. Therefore, many gynecologic oncologists no longer routinely use pelvic drains.



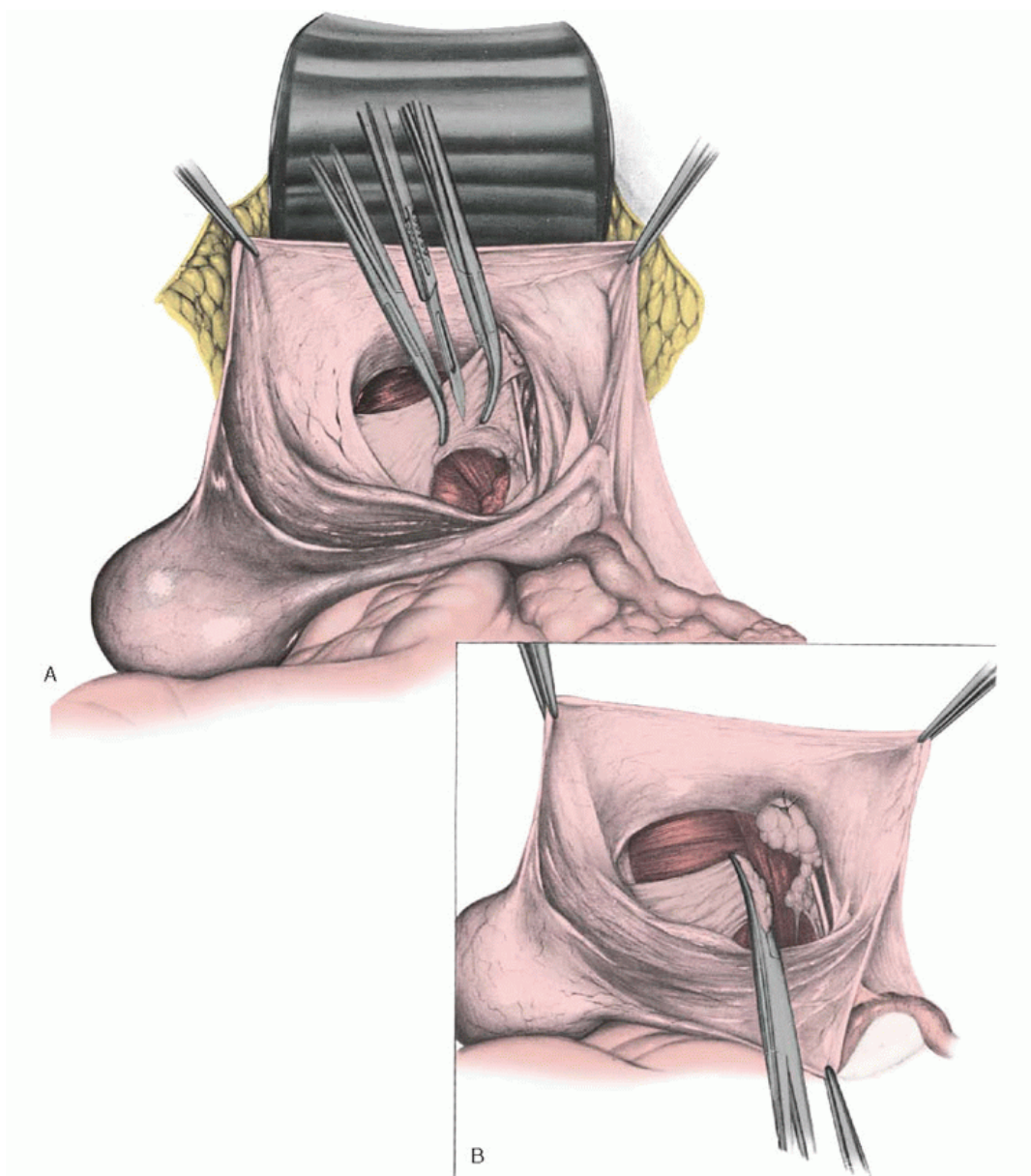


FIGURE 51.23 **A:** Clamping and incision of lateral portion of cardinal ligament adjacent to the lateral pelvic wall. **B:** Excised ligament showing pelvic floor and levator muscles. Dissected obturator nerve is seen in obturator space.

No attempt is made to suspend the ureters to the hypogastric artery, as suggested by Green and coworkers, or to place the terminal ureter on the inside of the peritoneal surface, as recommended by Novak. Furthermore, there appears to be no benefit to reperitonizing the pelvis as described by Symmonds and Pratt.

If the ovaries are to be transposed out of the pelvis, a tunnel is dissected beneath the peritoneum laterally and superiorly toward each lateral gutter. An incision in the peritoneum (*Print pagebreak 1224*) is made as high as possible at the top of the tunnel. The adnexal structures are guided through the tunnel and through the incision at the top of the tunnel, making absolutely certain that the ovarian vessels in the infundibulopelvic ligament are not twisted. Permanent suture material is used to suture the tubo-ovarian pedicle as high as possible to the peritoneum and underlying muscle. Two large metal clips also are placed across the pedicle to later identify the location of the ovaries with an abdominal radiograph. This ovarian suspension is done when there is a reasonable chance that a patient will need postoperative pelvic irradiation, and recent studies suggest that at minimum, the ovary should be placed 1.5 cm cephalad to the iliac crest based on planar radiology films ([Figs. 51.27](#) and [51.28](#)). In most operations, however, the tubes and ovaries can be left in their natural positions in the pelvis. If the ovary is to be transposed, it is reasonable to remove the tube and fimbriae; this may decrease the formation of future benign and malignant tubal disease and likely has limited compromise in the vascular perfusion to the remaining ovary.



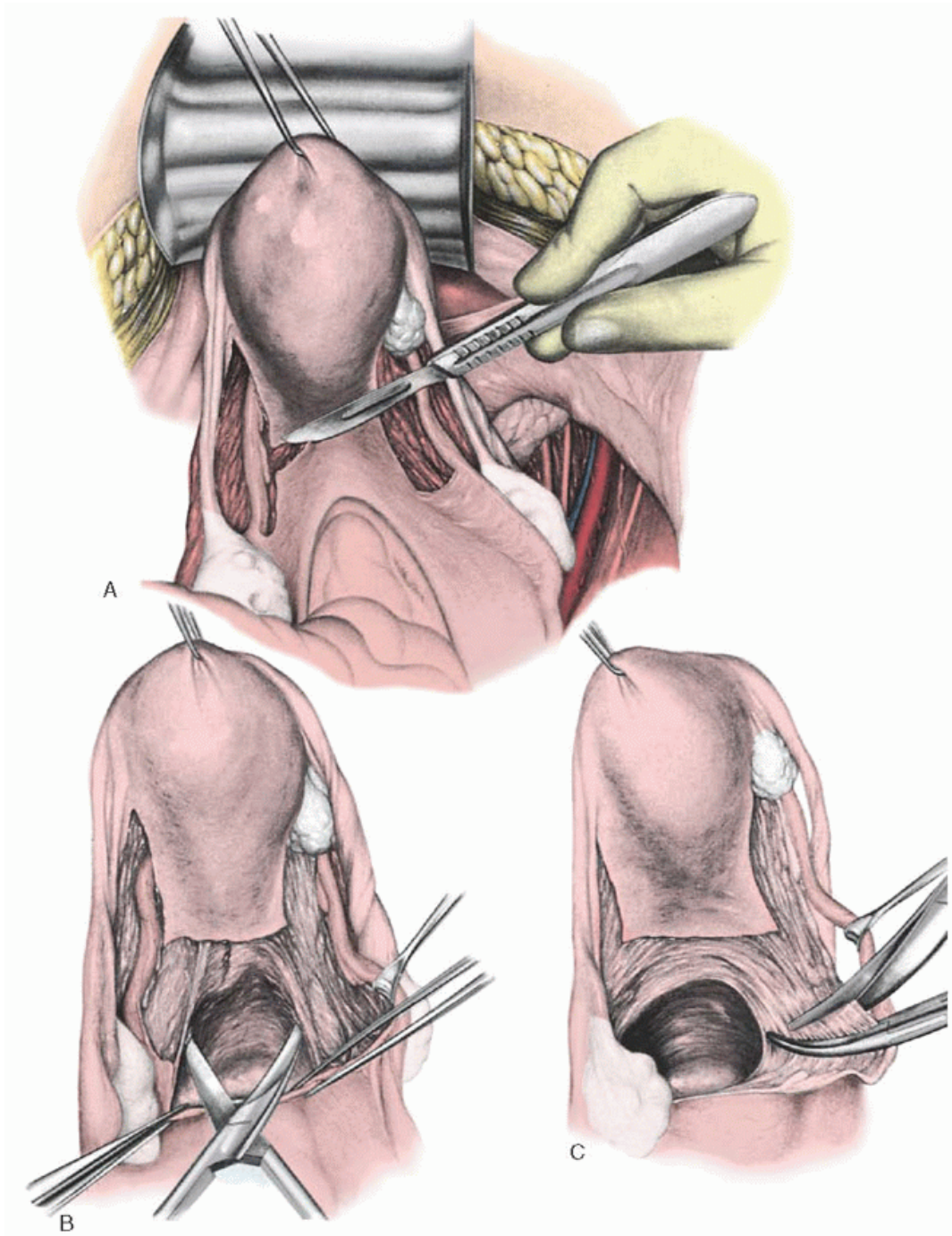


FIGURE 51.24 **A:** Cutting the cul-de-sac peritoneum as it reflects onto the rectum. Ureters course laterally, devoid of peritoneum. **B:** Dissection of the rectovaginal septum with development of rectal stalks (uterosacral ligaments). **C:** Clamping the uterosacral ligament. The ureter is gently retracted to avoid trauma.

(Print pagebreak 1225)



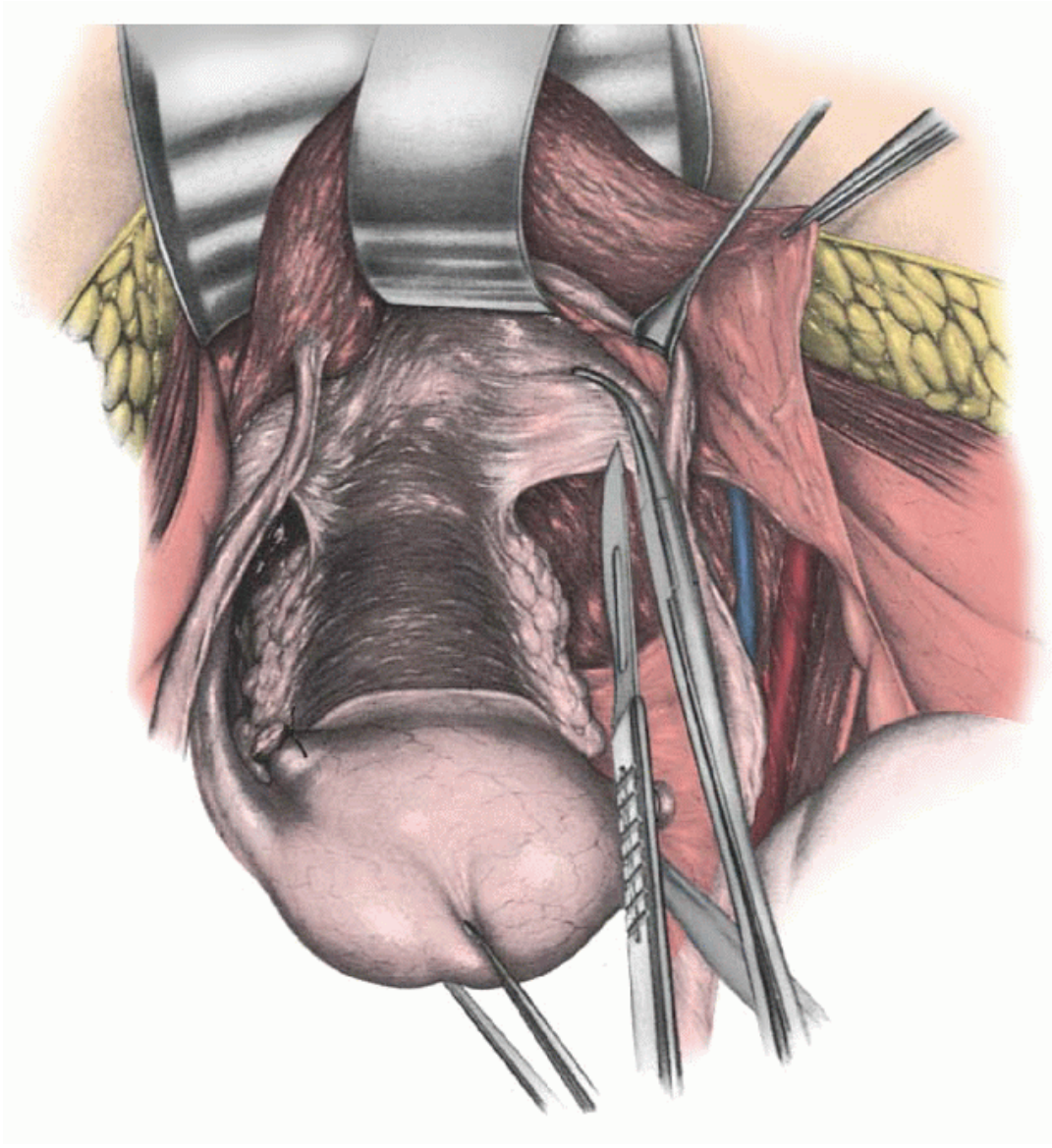


FIGURE 51.25 Dissection and retraction of bladder and terminal ureter from vagina and excision of the paravaginal fascia from the lateral pelvic wall.

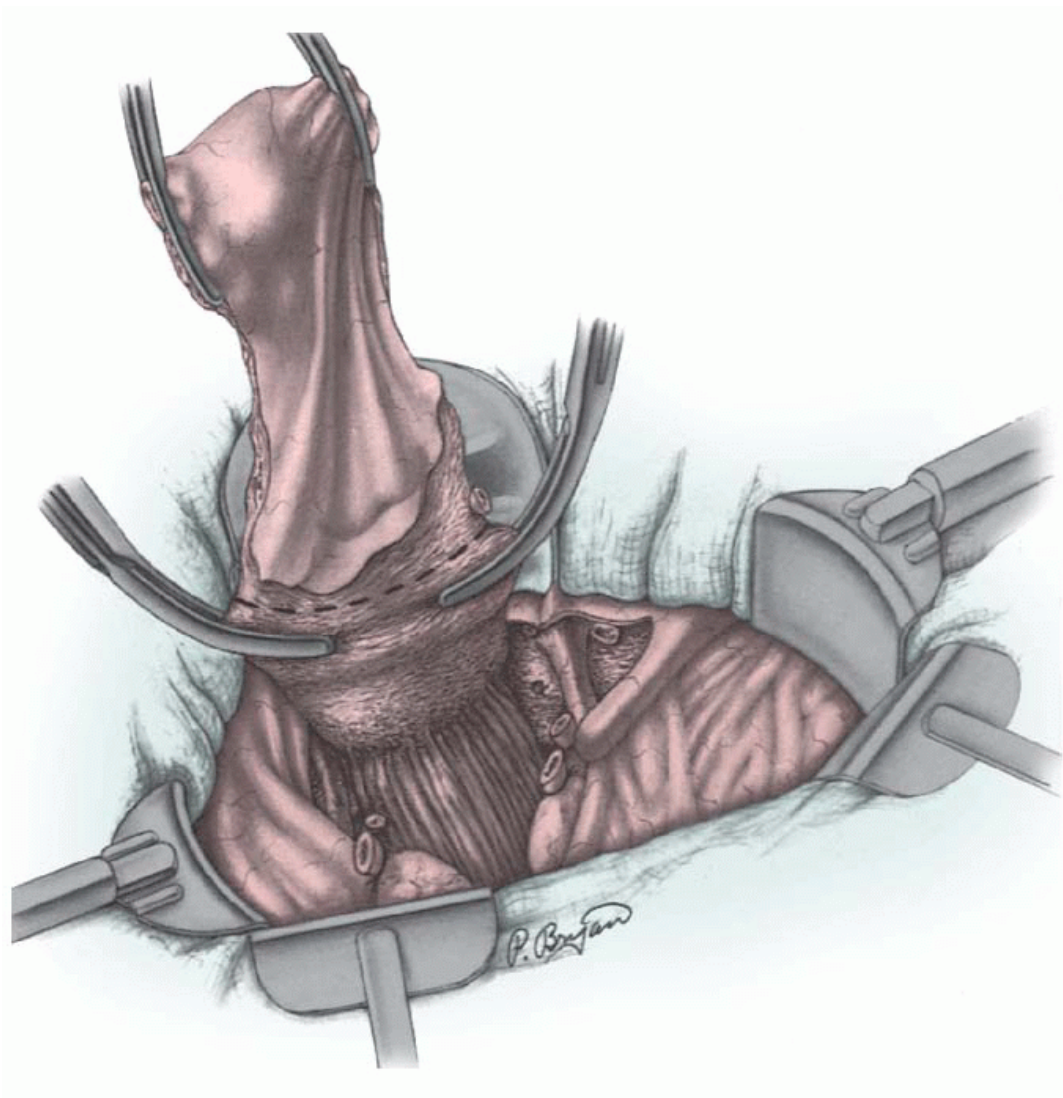


FIGURE 51.26 After clamping and ligating paravaginal tissue laterally, an incision is made in the vagina several centimeters below the cervix.

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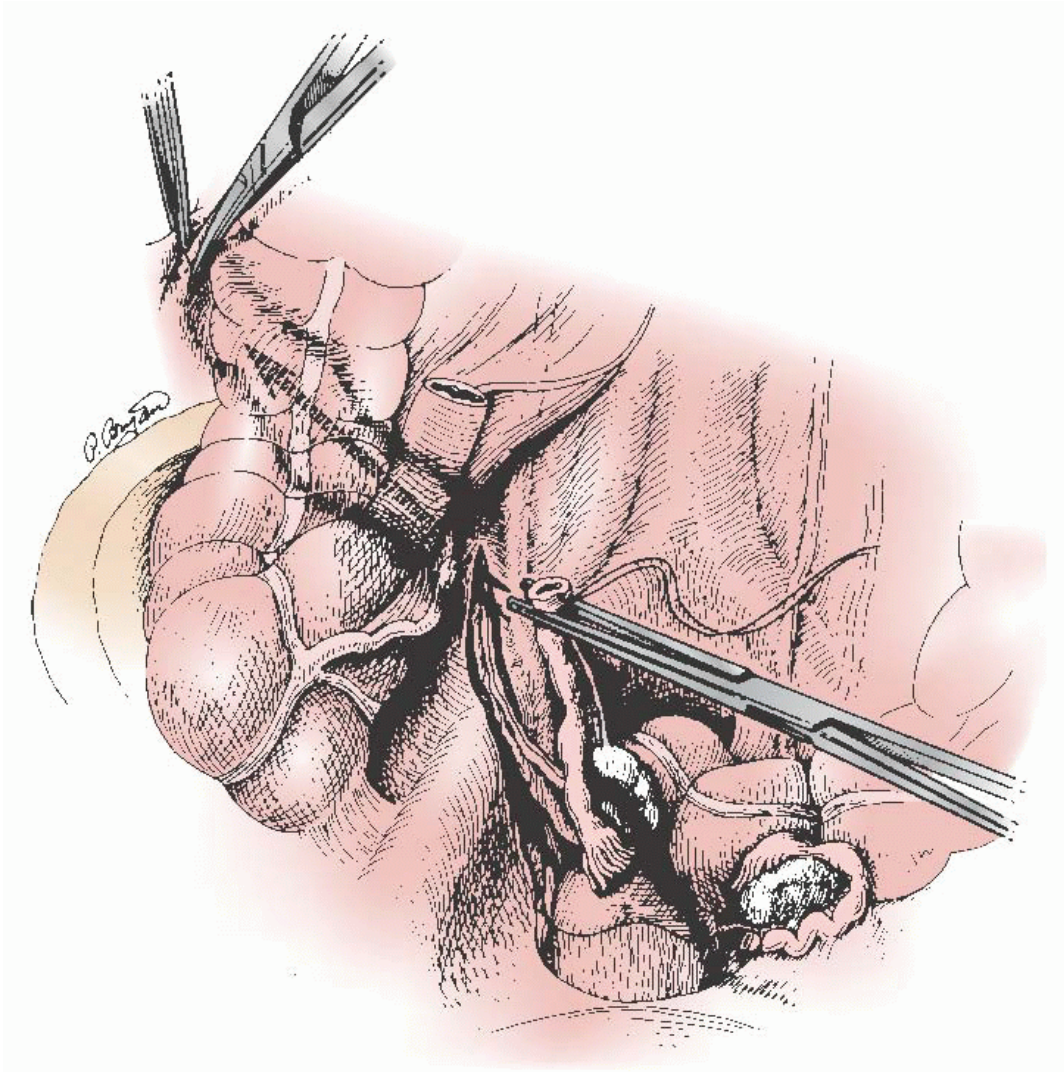


FIGURE 51.27 If the ovaries are to be suspended, a tunnel can be made under the peritoneum and the cecum on the right. The tube and ovary are guided through the tunnel to the new position in the right colic gutter above the pelvis.



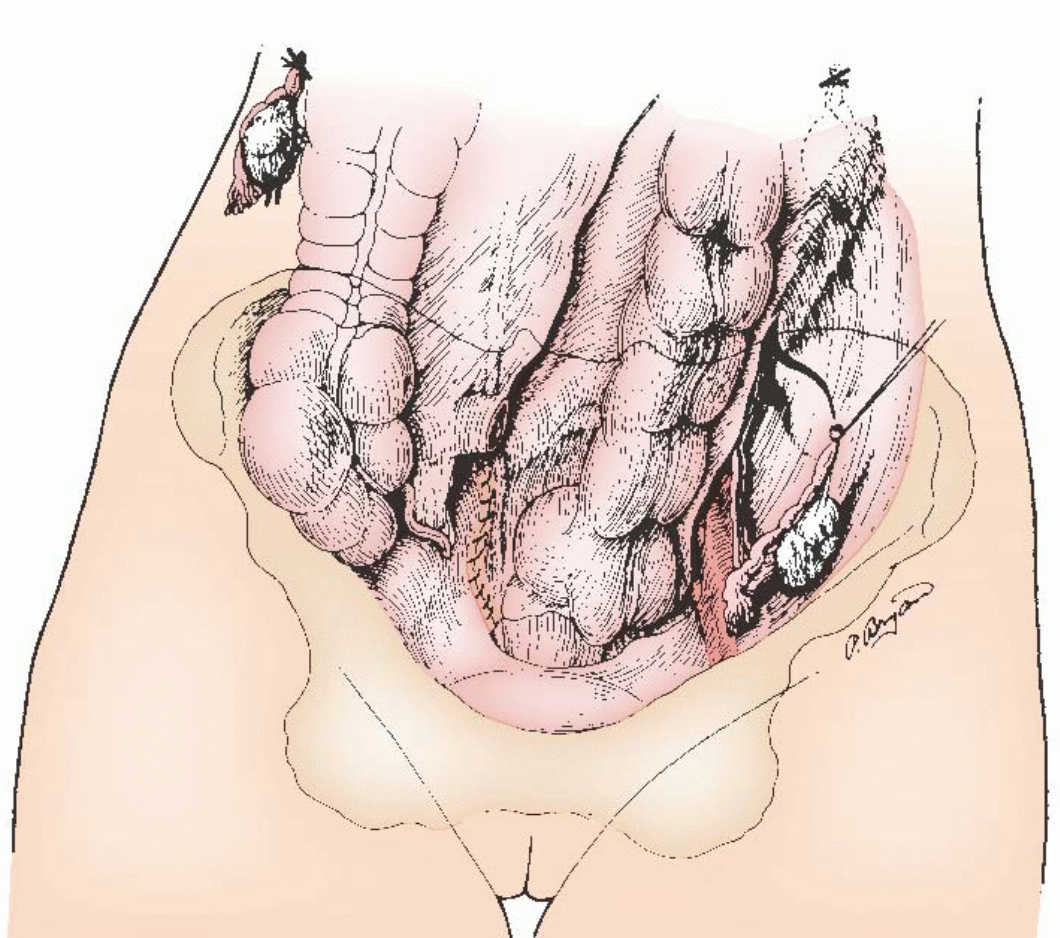


FIGURE 51.28 A similar procedure can be performed on the left. The ovarian vessels should not be twisted. Metal clips are placed on the pedicles to allow later identification with abdominal radiograph.

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FERTILITY-SPARING RADICAL ABDOMINAL TRACHELECTOMY

Historically, the recommended surgical treatment for a stage IA2-IB1 cervical cancer is a total radical hysterectomy and pelvic lymphadenectomy. This operation is very effective at treating early-stage cervical cancer; however, infertility is one of the serious and inevitable consequences of treatment. Partial radical organ resection has been accepted in many solid tumors, such as partial gastrectomy, nephrectomy, pneumonectomy, and colectomy to treat malignancies affecting these organs. In gynecologic oncology, partial organ resection with radical abdominal or vaginal trachelectomy and pelvic lymph node dissection are relatively new techniques used in women with early cervical cancer who wish to retain fertility ([Table 51.7](#)). This operation and technique are to be distinguished from the radical abdominal trachelectomy, which is occasionally used for resection of retained cervical stump malignancy following a previous supracervical hysterectomy in the setting in which fertility preservation is not an issue. The first reports of abdominal trachelectomy came from Europe in the 1950s by two separate gynecologists—F. Novak and E. Aburel; however, it is the work of D. Dargent in radical vaginal trachelectomy in the early 1990s that revived interest in the abdominal approach, with several investigators, namely, the Budapest team lead by L. Ungar, who started routinely performing the abdominal operation in adult women in 1997. The operation also appeared suited for pediatric cases with cervical cancer in whom the vaginal approach was not feasible; this approach was pioneered by a combined effort of the gynecology and pediatric surgery teams at Memorial Sloan Kettering Cancer Center in New York in 2004.

TABLE 51.7 Summary of Series Describing Fertility-Sparing Radical Abdominal Trachelectomy

AUTHOR	N ^a	AGE (YEARS)	STAGE	EBL (ML)	COMPLICATIONS	REBIRTHS	RECURRENT
Smith et al. (1997)	1		IB				





Rodriguez et al. (2001)	3	26.3	IA1-IA2	417	1 abscess	1	0
Palfalvi (2003)	1		IB1			1	
Del Priore et al. (2004)	1	28	IB1				Pelvic at 6 mo
Ungar et al. (2005)	33	30.5	IA2-IB2		6% amenorrhea	2	0, median follow-up, 47 mo
Abu-Rustum et al. (2005)	2	7	IB1		0	0	0
Ungar et al. (2006)	91	30.7	IA2-IB2	656	4.8% amenorrhea	6	2.4%
Cibula et al. (2005)	3		IA2-IB1	350-3,500	1 ileus 1 bladder atony		
Bader et al. (2005)	1	34	IB1			0	1
Abu-Rustum et al. (2006)	5	36	IB1	280	1 needed completion hysterectomy for positive margin	0	0
Li et al. (2011)	62 ^c	29.5	IA1-IB1	362	2 infected pelvic lymphocysts	1	0
Wethington et al. (2012)	101	31	IA1-IB2		5 cervical stenoses 12 cervical stenoses 4 lymphocele 4 ileus	16	4

^a Some patients may be reported more than once.

^b Mean when calculated. ^c Three pediatric cases

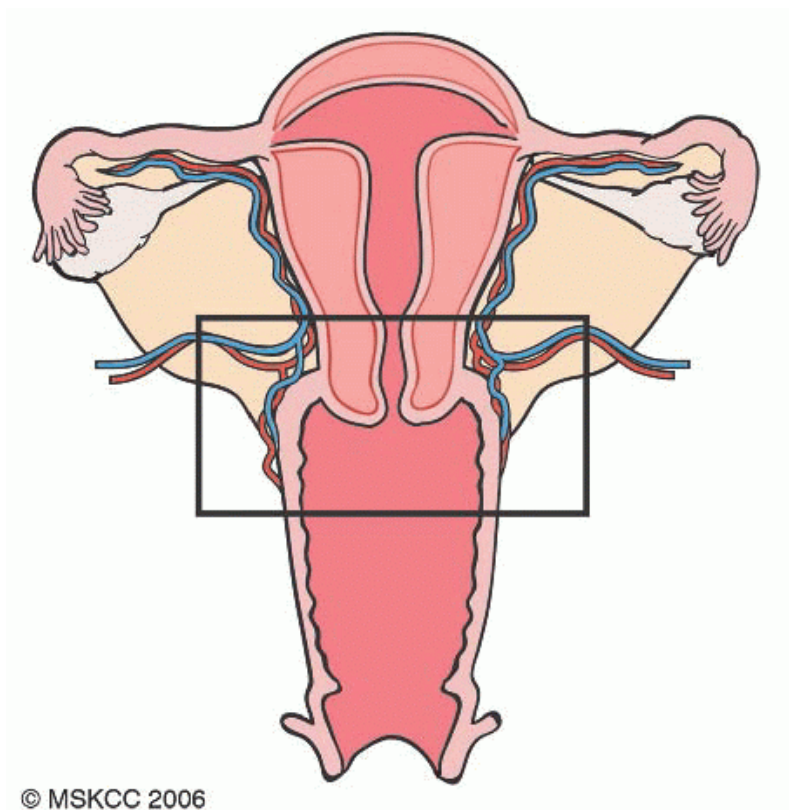
EBL, estimated blood loss.

Technique

A laparotomy and a bilateral complete pelvic lymphadenectomy are performed in a similar manner to a radical abdominal hysterectomy. The limits of nodal dissection are the deep circumflex iliac vein caudally and the proximal common iliac artery cephalad. Any suspicious lymph nodes are sent for frozen section analysis. It is our intent to abandon a fertility-sparing approach if positive lymph nodes are identified. SLN biopsy following a structured algorithm is also a reasonable option and may allow for pathologic ultrastaging of these SLNs. The removal of paraaortic nodes is also considered for select lesions stage **IB1** or greater.

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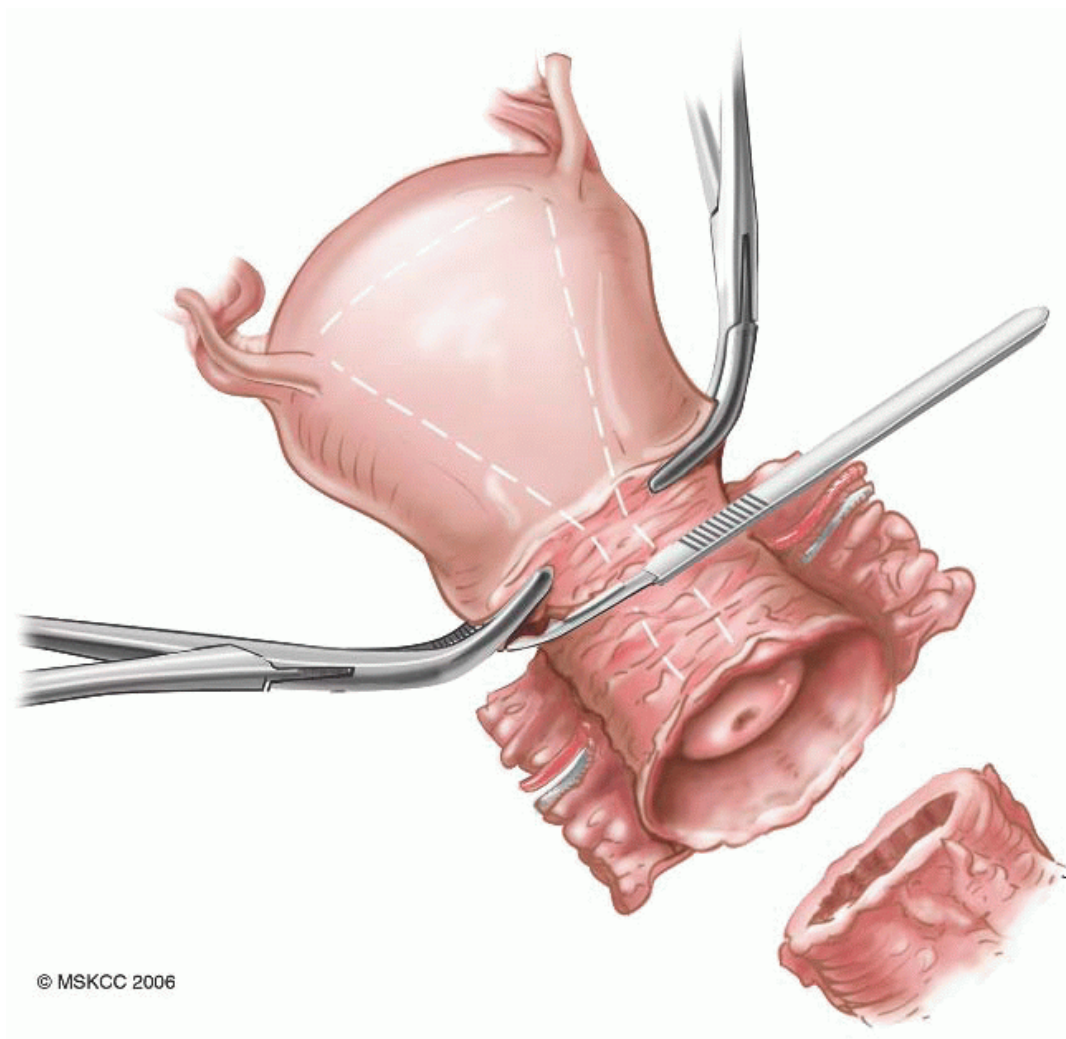
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FIGURE 51.29 Diagrammatic representation of the tissue renewed at radical abdominal trachelectomy.

The intent of the radical abdominal trachelectomy is to resect the cervix, upper 1 to 2 cm of the vagina, parametrium, and paracolpos in a similar manner to a type C1 nerve-sparing radical abdominal hysterectomy while preserving the uterine fundus or corpus ([Figs. 51.29](#) and [51.30](#)).

The procedure is begun by developing the paravesical and pararectal spaces and dissecting the bladder caudal to the midvagina. The round ligaments are divided (some surgeons preserve the round ligaments), and large Kelly clamps are placed on the medial round ligaments to manipulate the uterus. Care is taken not to destroy the cornu or the utero-ovarian pedicles. The infundibulopelvic ligaments, with ovarian blood supply, are kept intact. Care is also taken not to injure the fallopian tubes or disrupt the utero-ovarian ligament.





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FIGURE 51.30 The intent of the radical abdominal trachelectomy is to resect the cervix, upper 1 to 2 cm of the vagina, parametrium, and paracolpos in a similar manner to a type III radical abdominal hysterectomy but sparing the uterine corpus.

The uterine vessels are then ligated and divided at their origin from the hypogastric vessels. The parametria and paracolpos with uterine vessels are mobilized medially with the specimen, and a complete ureterolysis is performed similar to a type C1 radical abdominal hysterectomy. The posterior cul-de-sac peritoneum is incised and the uterosacral ligament divided; similarly, the parametria and paracolpos are divided. Using a vaginal cylinder (Apple Medical Corporation; Marlborough, MA), the desired length of vaginectomy is performed, and the specimen is completely separated from the vagina and placed in the midpelvis, keeping its attachment to the utero-ovarian ligaments.

The lower uterine segment is then estimated, and clamps are placed at the level of the internal os ([Fig. 51.31](#)). Using a knife, the radical trachelectomy is completed by separating the fundus from the isthmus or upper endocervix at approximately 5 mm below the level of the internal os, if possible ([Figs. 51.32](#) and [51.33](#)).

The uterine fundus with preserved attachments to the uteroovarian ligaments, placed in the superior part of the pelvis, and the specimen, consisting of radical trachelectomy and parametria with suture marking the vaginal cuff at 12 o'clock, are sent for frozen section evaluation of its endocervical margin. The uterine fundus is inspected, and curettage of the endometrial cavity is performed as well as a shave disc margin on the remaining cervical tissue, which is sent for frozen section analysis ([Fig. 51.34](#)). This is performed to ensure that the reconstructed uterus to the vagina is disease free. A frozen section analysis is also obtained on the distal vaginal margin, if clinically indicated.

If all frozen sections tested are benign and at least a 5-mm clear margin is obtained on the endocervical edge, a permanent cerclage with no. 0 Ethibond or no. 0 GoreTex suture (knot tied posteriorly) may be placed before the reconstruction ([Fig. 51.35](#)). Some surgeons do not recommend cerclage. The uterus is then reattached to the upper vagina with six to eight no. 2-0 absorbable sutures ([Figs. 51.36, 51.37](#) and [51.38](#)). No drains are placed. Standard antibiotic prophylaxis and routine postoperative care is prescribed. We do not routinely place a stent or IUD into the uterus, but some investigators suggest it may help reduce the risk of postoperative





stenosis; however, neocervical stenosis can occur beyond 6 weeks postsurgery, and such short-term devices used in the immediate post-op weeks are unlikely to affect that outcome. Use of vaginal dilators starting at 6 weeks post-op may help reduce the extent of upper vaginal agglutination around the neocervix.

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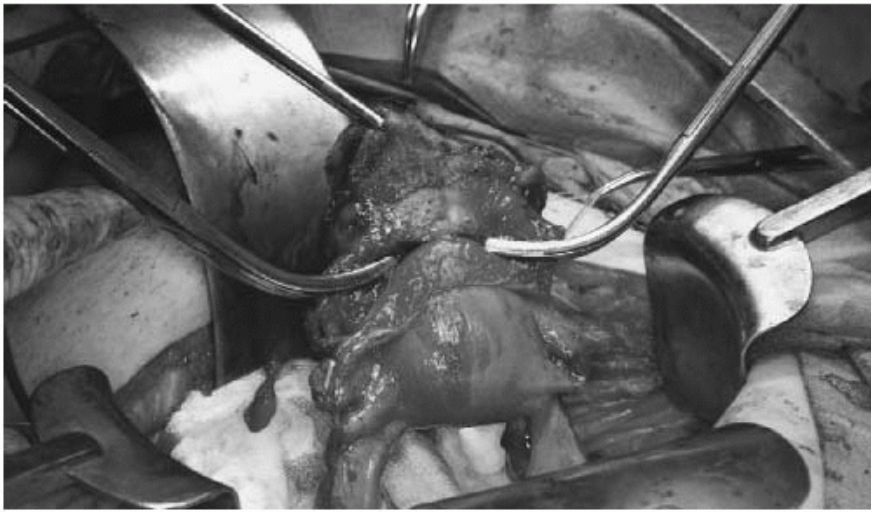


FIGURE 51.31 The uterus is separated from the vagina and remains attached to the adnexa and utero-ovarian vessels.

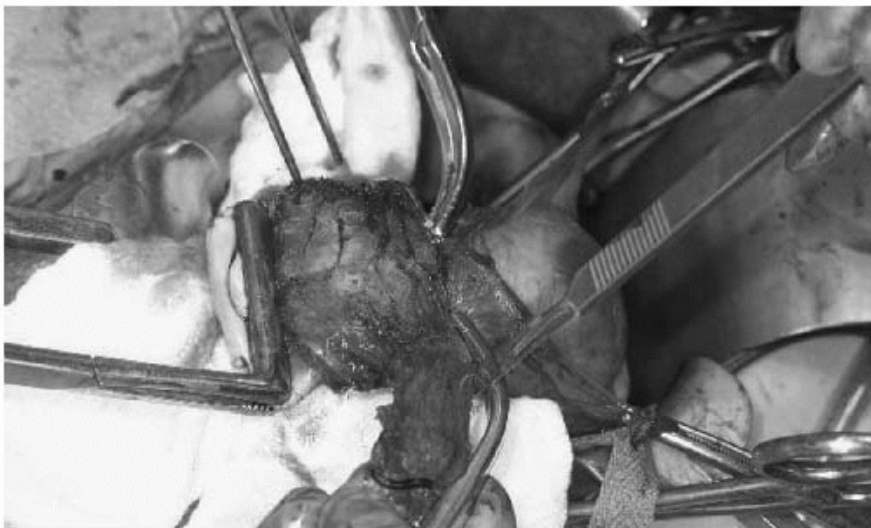


FIGURE 51.32 The radical abdominal trachelectomy incision is done at or just below the internal os, ideally preserving 5 mm or so of upper endocervix.





FIGURE 51.33 Radical abdominal trachelectomy: The cervical tissue and parametria are separated from the fundus.

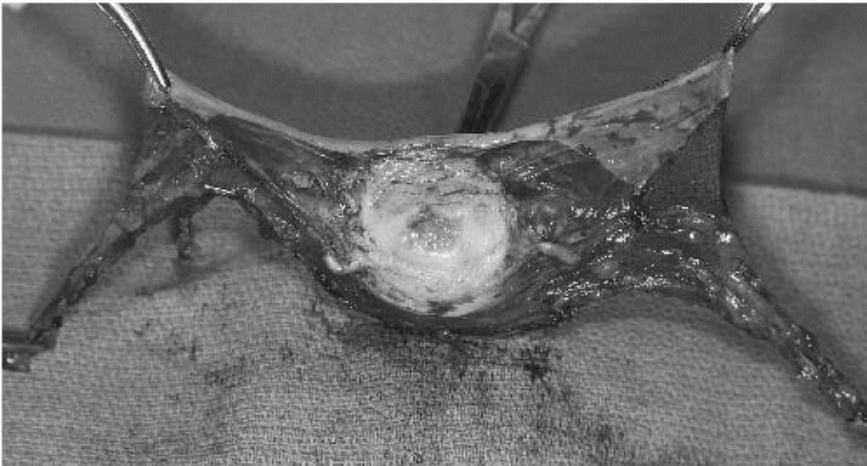


FIGURE 51.34 Radical abdominal trachelectomy specimen showing endocervical margin and uterine vessels with parametria. Endometrial and upper endocervical curettage as well as a shave margin on the remaining uterine tissue is sent for frozen section analysis before reconstruction.



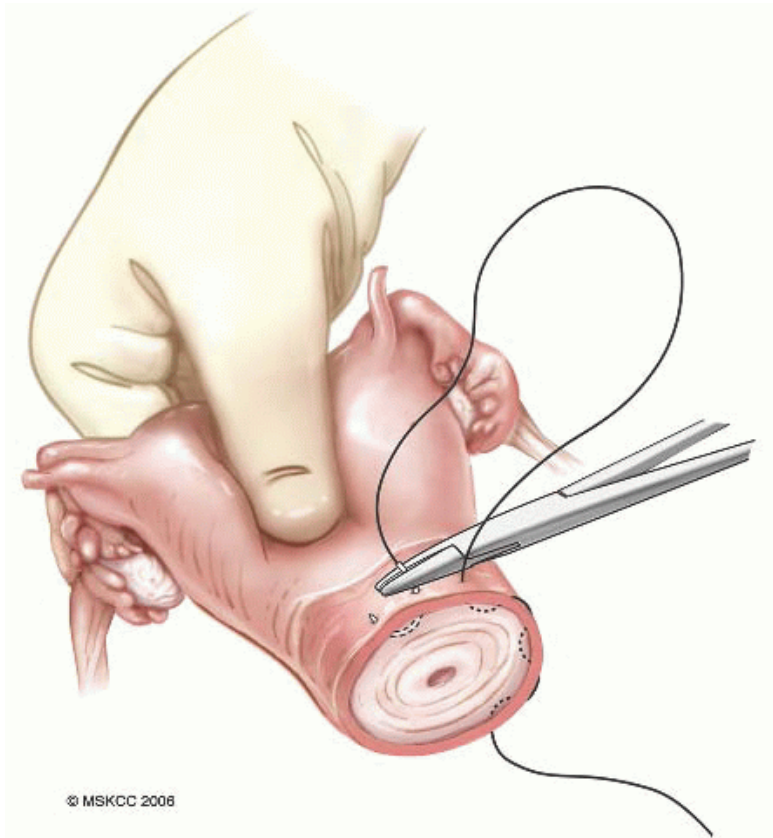


FIGURE 51.35 A permanent cerclage with no. 0 Ethibond is placed and the knot tied posteriorly.

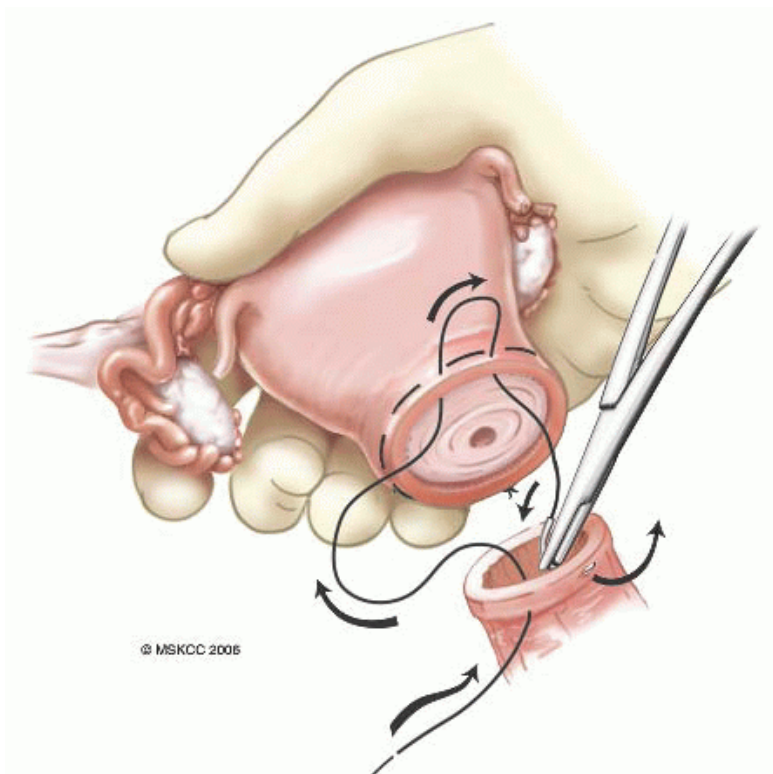


FIGURE 51.36 Reconstruction of the uterine corpus to upper vagina after the cerclage is placed.



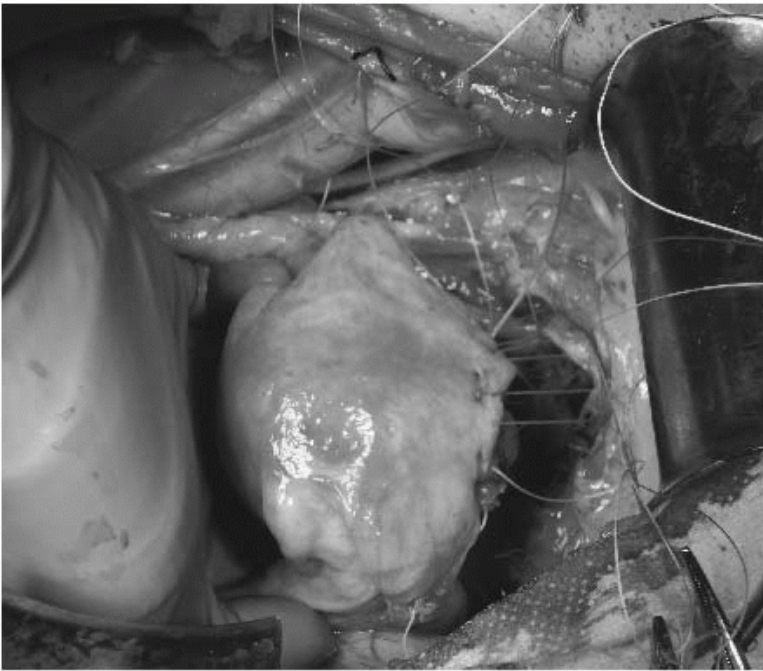


FIGURE 51.37 The uterine fundus is reattached to the vaginal apex with six to eight interrupted no. 2-0 absorbable sutures.

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FIGURE 51.38 The reconstructed fundus with remaining blood supply from the intact utero-ovarian ligaments: uterine serosa without evidence of fundal ischemia.

An alternative approach to performing the operation, similar to what Aburel described, is to separate the fundus from the cervix before the colpotomy, pack the fundus with the intact utero-ovarian blood supply in the upper pelvis, place retraction clamps on the cervix, and perform the radical trachelectomy. The role of cystourethroscopy with bilateral temporary ureteral catheterization is optional.

LAPAROSCOPICALLY ASSISTED RADICAL VAGINAL HYSTERECTOMY (SCHAUTA)





History

The “extended” hysterectomy performed vaginally for the treatment of cervical cancer was invented by Schauta in Austria in 1901. A few years earlier, in 1898, also in Austria, Wertheim had reported on the abdominal extended hysterectomy. The mortality and morbidity of the Wertheim method was initially much higher, but it had the advantage of including a pelvic lymphadenectomy, which is now appreciated as an important and necessary part of the procedure. Because the initial Schauta operation did not include the lymph node assessment, it gradually became less popular. In 1959, Mitra combined the Schauta operation with a retroperitoneal approach for the pelvic lymphadenectomy. This was a clever idea, but it did not gain a lot of acceptance because it necessitated bilateral flank incisions. More recently, in 1987, Dargent revived the Schauta operation by combining it with laparoscopic surgery, allowing thorough and complete pelvic lymphadenectomy. The Schauta operation preceded by a laparoscopic pelvic lymphadenectomy is thus a perfect example of the recent trend toward minimally invasive surgery in gynecologic oncology.

Technique

Laparoscopic Part of the Surgery

Pelvic Lymphadenectomy

The procedure begins with a complete laparoscopic pelvic lymphadenectomy using a 4-trocar technique, as detailed in the laparoscopic surgical staging section below. In the future, if SLN mapping proves acceptable to gynecologic oncologists, the extent of the lymphadenectomy may be further minimized to the removal of only the SLNs.

Division of the Uterine Artery

Caudally to the crossing point of the uterine artery, an opening is created bluntly just under the superior vesical artery, which is then retracted laterally in such a way that the uterine vessels lie between the two openings created. Once the uterine artery is divided, the stump can be retracted medially and freed gently from the ureter. This will facilitate the dissection of the uterine artery vaginally. Of note, several collaterals of the uterine artery are frequently encountered and should be clipped, excised, or cauterized individually to avoid bleeding. The vaginal branch of the uterine artery is also frequently seen appearing under the excised uterine artery. It can be divided now or later during the vaginal excision of the parametrial tissue. Lastly, the uterine veins are usually located under the artery and again should be managed individually. On occasion, uterine veins cross over the ureter and can be the source of bleeding during the vaginal part of the surgery.

Vaginal Part of the Surgery

The vaginal part of the surgery can be divided into five steps: (a) vaginal cuff preparation, (b) anterior phase (opening of the vesicouterine space and paravesical space and mobilization and dissection of the ureter), (c) posterior phase (opening of the cul-de-sac and pararectal space and excision of the paracolpos), (d) lateral phase (excision of the parametrium), and (e) excision of the specimen and closure.

Vaginal Cuff Preparation

Because the radical vaginal hysterectomy is primarily offered to women with cervical lesions less than 3 cm, it is rarely necessary to remove more than 1 cm of vaginal mucosa. A rim of vaginal mucosa is delineated circumferentially clockwise around the cervix with six to eight straight Kocher clamps placed at regular intervals, about 1 cm below the cervix ([Fig. 51.39](#)).

To reduce bleeding from the edges of the vaginal mucosa, a 10- to 20-mL solution of xylocaine 1% mixed with epinephrine 1:100,000 is injected between each Kocher clamp, and then a circumferential incision is made with the scalpel just above the Kocher clamp ([Fig. 51.40](#)). The anterior and posterior edges of the vaginal mucosa are grasped with four to six Chrobak clamps to completely cover the cervix.

Anterior Phase (Described for the Patient's Right Side)

OPENING OF THE VESICOUTERINE SPACE

While pulling the specimen slightly downward with the Chrobak clamps, a single-tooth forceps is used to hold and retract the anterior vaginal mucosa, which usually creates a triangular fold indicating where to cut ([Fig. 51.41](#)). The vesicouterine space is opened with Metzenbaum scissors held perpendicular to the cervix in the midline to avoid bleeding from the bladder pillars laterally.





The space is further defined and stretched by gentle dissection with the index finger. Care is taken not to enter the anterior peritoneum as in a simple vaginal hysterectomy as (*Print pagebreak 1231*) it makes identification of the bladder base and ureters more difficult. If entered correctly, the space should be avascular, and the anterior surface of the endocervix and isthmus should be easily identified without resistance. If resistance is encountered, it usually means that the plane of dissection is either too posterior and that the surgeon is digging into the endocervix, or too anterior, which carries a risk of damage to the bladder. For that reason, the bladder base should be carefully delineated. In patients who have had a recent conization, there may be substantial fibrosis and scarring between the cervix and the bladder base. The opening of the vesicouterine space may be particularly difficult in those cases. In such situations, a metal bladder catheter introduced in the urethra may be used to locate the bladder base and facilitate its mobilization. Once clearly identified, the vesicouterine space is stretched upward with a narrow Deaver retractor, showing the intact peritoneum ([Fig. 51.42](#)).



FIGURE 51.39 A vaginal cuff is prepared to remove about 1 to 2 cm of vaginal mucosa.

OPENING OF THE PARAVESICAL SPACE

To open the right paravesical space, the Chrobak clamps are slightly pulled toward the patient's right side. Straight Kocher clamps are placed onto the vaginal mucosa at 11 and 9 o'clock and stretched out (this is where the 12-o'clock mark made earlier is useful). This maneuver defines a triangle formed by the bladder pillars, the vaginal mucosa, and the Chrobak clamps. An areolar opening is seen just medial and slightly anterior to the 9-o'clock clamp, indicating where to enter to define the paravesical space. The space is blindly entered by opening and closing Metzenbaum scissors, with the tips pointing upward and outward in an oblique axis. If entered correctly, the space should be avascular and the scissors should slide inside easily. Once entered, the space is widened by rotating the scissors under the pubic bone in a semicircular, rotating motion to the patient's left side. A small Breisky retractor is then placed in the space. This step is unquestionably the most "scary" part of the procedure as it is a blind maneuver. Having defined the paravesical space laparoscopically facilitates the entry of the scissors.



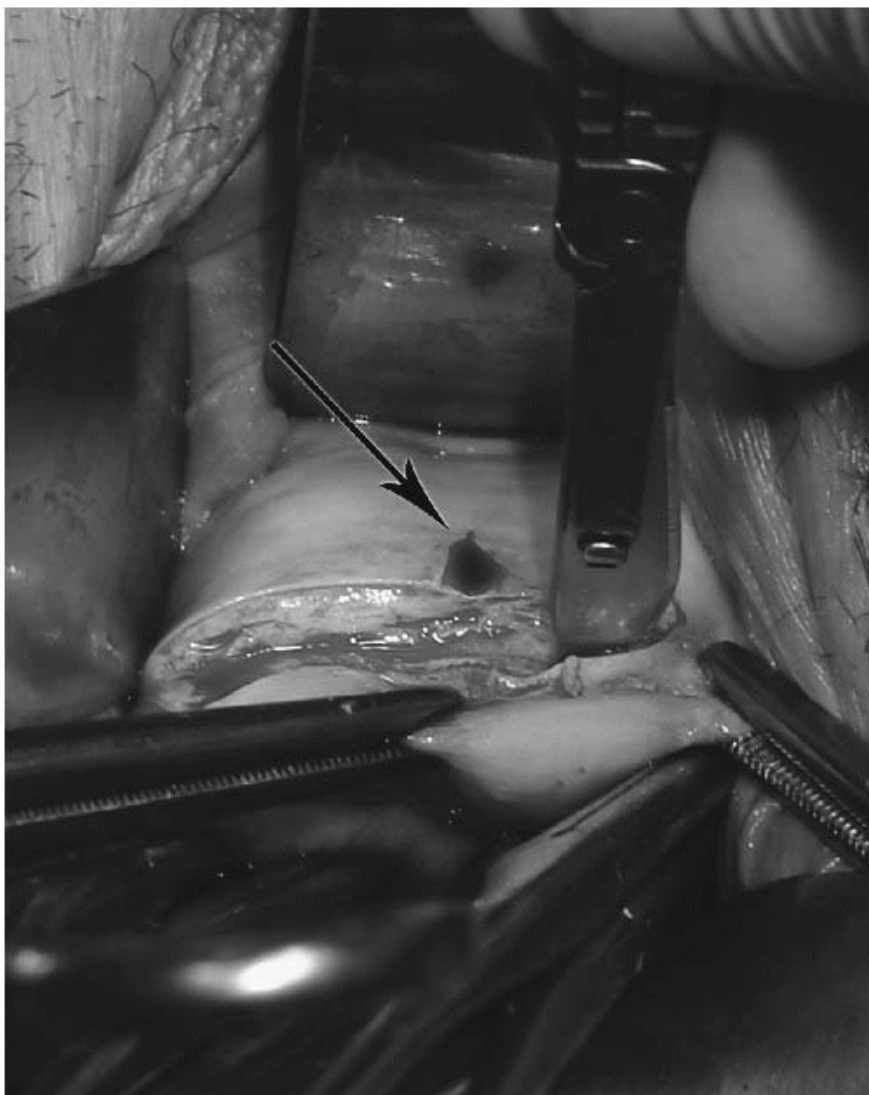


FIGURE 51.40 Section of the anterior vaginal mucosa, with the 12-o'clock mark (*arrow*).

IDENTIFICATION AND MOBILIZATION OF THE URETER

To palpate the ureter, the Chrobak clamps are pulled to the left of the patient, and the surgeon's right index finger is placed in the vesicouterine space while a Breisky retractor (or the back of the scissors) is placed in the right paravesical space. By pulling down and “rubbing” the finger against the Breisky retractor, the “click” of the ureter rolling under the finger should be heard and felt. This maneuver orients the surgeon as to the location of the ureter in relation to the bladder pillars. Next, with the Breisky retractor placed in the right paravesical space and the narrow Deaver retractor placed in the vesicouterine space, the bladder pillars are clearly identified. The knee of the ureter is normally located on the lateral aspect of the bladder pillars ([Fig. 51.43](#)).

Once the ureter has been precisely located by palpation, the bladder pillars are excised midway between the bladder base and the endocervix. (Bipolar scissors are useful to decrease bleeding from the bladder pillars.) With the scissors, the medial and lateral pillars of the bladder pillars should be separated first before cutting ([Fig. 51.44](#)). The most proximal fibers of the pillars can then be excised, and normally, the knee of the ureter should appear anteriorly. At that point, a Babcock clamp is extremely useful to grab the ureter to allow a good traction on it and to constantly keep it under direct visualization. Once the ureter is clearly identified, the medial and lateral bladder pillars are safely excised. If the ureter is not seen unequivocally, it should be palpated again to relocate its position before cutting the pillars.

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FIGURE 51.41 Opening of the vesicouterine space, with the Chrobak clamps pulling the vaginal cuff.



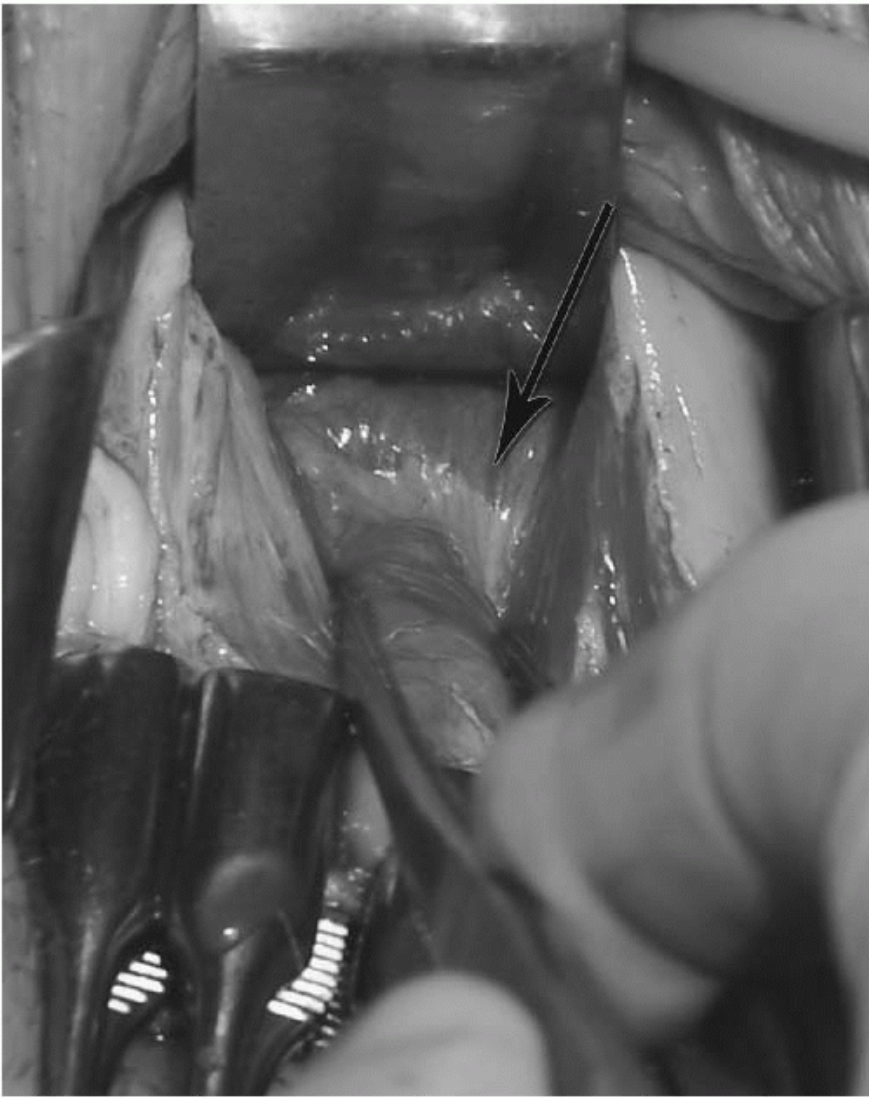


FIGURE 51.42 The vesicovaginal space is open, showing the intact peritoneum (*arrow*).



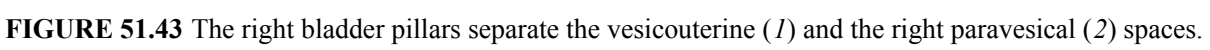




FIGURE 51.44 The ureter is localized by opening the bladder pillars.

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DISSECTION OF THE URETER

Once the ureter is clearly identified and placed under traction with a Babcock clamp, it is possible to dissect the ureter. (It is easier if part of the unroofing has been done laparoscopically.) The uterine vessels are usually seen just under the knee of the ureter ([Fig. 51.45](#)). With a Kelly clamp, the vessels are pulled down from under the ureter, while at the same time, Metzenbaum scissors are used to free the filmy attachments and allow mobilization of the ureter upward. The uterine artery can be drawn completely into the operative field along with the clips (if they have been used laparoscopically to divide the uterine artery).

Posterior Phase (Described for the Patient's Right Side)

OPENING OF THE CUL-DE-SAC

Chrobak clamps are sharply angulated anteriorly, and the posterior cul-de-sac is opened using Metzenbaum scissors as for a simple vaginal hysterectomy. Once entered, the space is stretched laterally to allow placement of a retractor.

OPENING OF THE PARARECTAL SPACE AND EXCISION OF THE UTEROSACRAL LIGAMENTS

Using Metzenbaum scissors, the pararectal space is defined by opening a space just lateral to the peritoneal folds of the uterosacral ligaments. The medial or rectouterine fibers of the uterosacral ligaments are separated and excised.



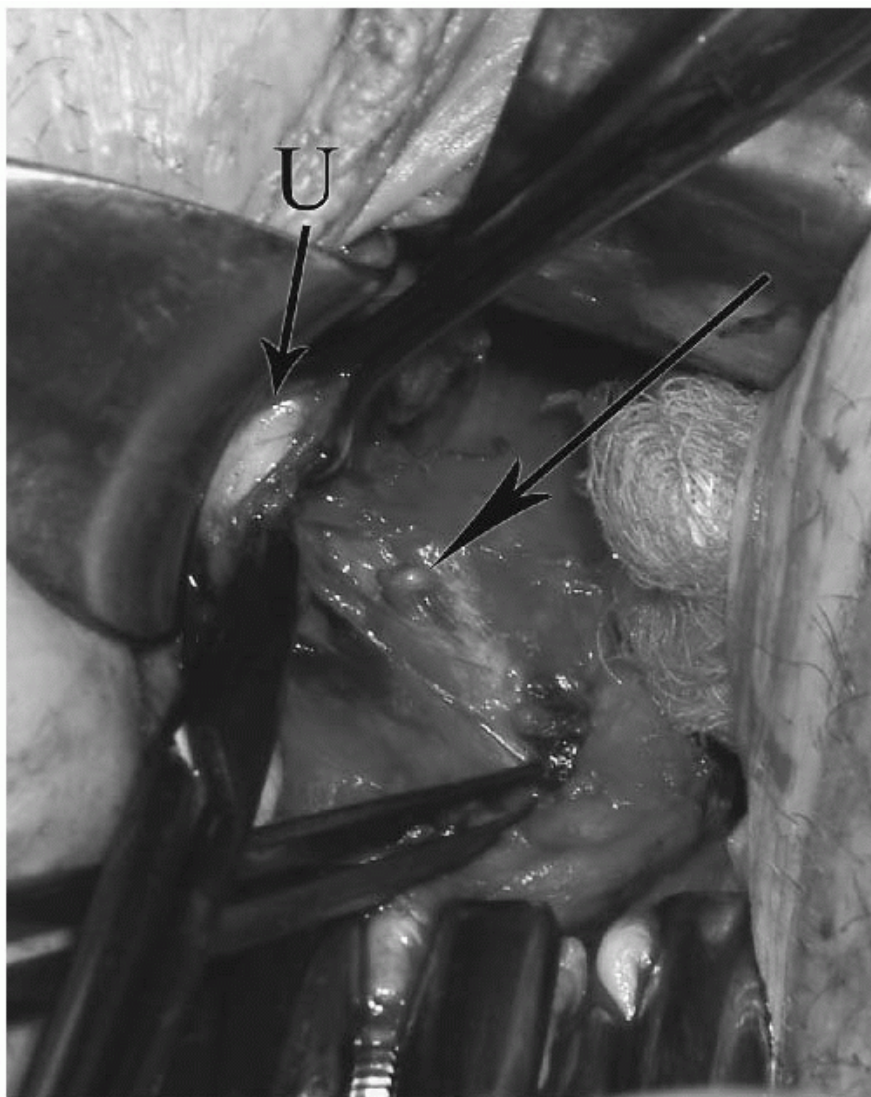


FIGURE 51.45 After dissection of the ureter (*U*), the uterine vessels are seen underneath (*arrow*).

EXCISION OF THE PARACOLPOS

To complete the posterior phase preparation, the paracolpos is excised. The paracolpos is the inferior border of the parametrium. With the Chrobak clamps rotated to the left, the paracolpos is clamped just medial to the vaginal mucosa, excised, and ligated.

Lateral Phase (Excision of the Parametrium)

Before clamping the parametrium, the paravesical space and the ureter should be relocated. The space is verified by palpation with the finger, and a Breisky retractor is replaced in the paravesical space. The ureter should be readily visible and placed under traction with a Babcock clamp. While the Chrobak clamps are pulled and rotated to the patient's left side, a curved Heaney clamp is placed proximally on the parametrium, and then a second clamp is placed higher and more lateral to obtain wider parametrium. The second Heaney clamp should be placed at the contact of the knee of the ureter, which can be further dissected if needed ([Fig. 51.46](#)). The parametrial tissue is excised and ligated.

Once completed on the other side, the uterus can now be tilted backward and should only be held by the ovarian ligaments (if the adnexae are preserved) or by residual peritoneal attachments. These can be clamped, excised, and ligated. The specimen is removed ([Fig. 51.47](#)).

Closure

In general, an attempt is made to include the anterior and posterior pelvic peritoneum along with the vaginal mucosa. Interrupted figures-of-eight of Vicryl 2-0 sutures are used for the closure, starting with the lateral angles. No drains are left in place, except for the Foley catheter.



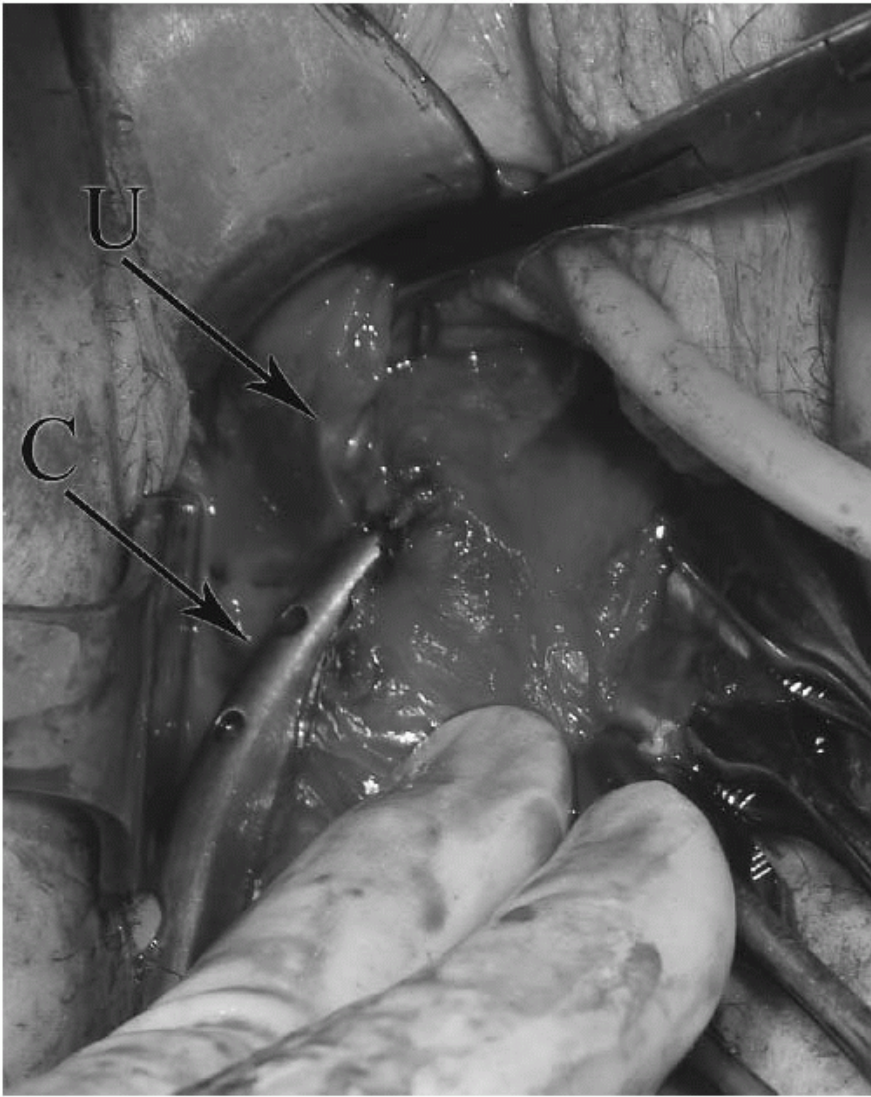


FIGURE 51.46 A clamp (C) has been applied to the right parametrium, very close to the ureter (U).

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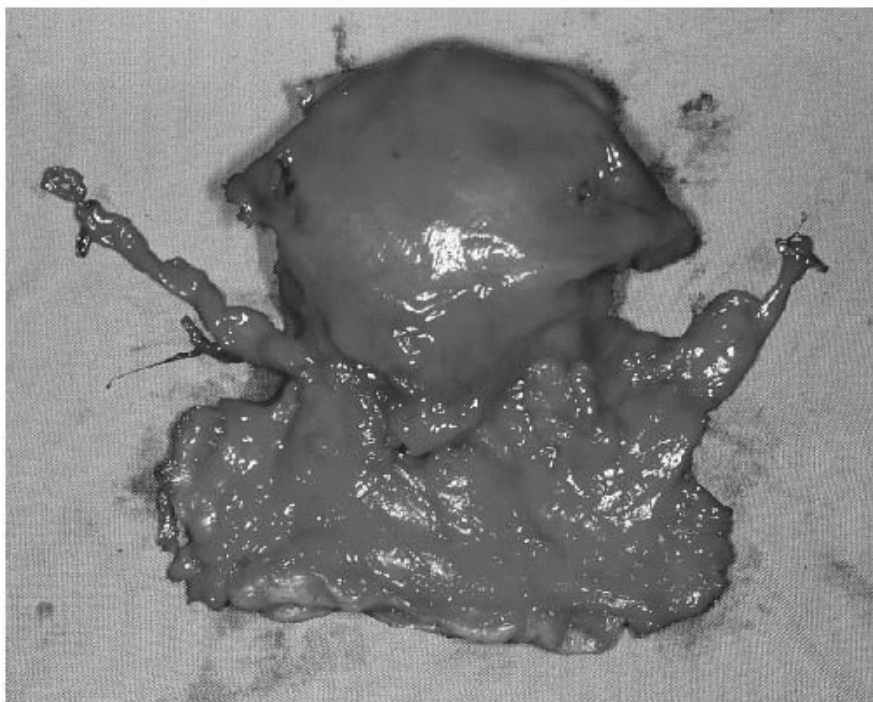


FIGURE 51.47 Specimen with parametrium and uterine arteries.

Results

Over the last two decades, data have been accumulating in the literature to indicate that the laparoscopically assisted radical vaginal hysterectomy is a safe procedure, with an overall low morbidity rate. Several studies—including those of Jackson and associates, Malur and colleagues, Nam and coworkers, Renaud and associates, Roy and colleagues, and Steed and coworkers—compared laparotomy versus laparoscopically assisted vaginal route. In general, the data suggest that the operative time is longer for the laparoscopically assisted vaginal group, but blood loss, transfusion rate, and hospital stay are significantly lower. The lymph node yield is similar between the two groups. Malur even reported a higher lymph node count in the laparoscopically assisted vaginal group. The intraoperative complication rate appears to be higher in the laparoscopically assisted vaginal group, probably related in part to the initial learning curve. In the study by Steed and coworkers, most of the complications were related to bladder and ureteral injuries. However, postoperative complications, such as wound infection and bleeding, tend to be higher in the laparotomy group. Jackson and associates reported the incidence of bladder and bowel dysfunction to be less in the laparoscopically assisted vaginal group, whereas Steed and coworkers found the opposite. Renaud and associates reported that the conversion rate to laparotomy is low. Importantly, there does not appear to be a statistically significant difference in recurrence rate and overall survival, suggesting that the radicality of the vaginal approach is adequate. However, Nam and coworkers noted a higher recurrence rate in the laparoscopically assisted vaginal group in patients with larger tumor volume and concluded that the vaginal approach should be restricted to patients with small tumor (<2 cm).

For larger-sized lesions, Possover and colleagues and Querleu have described a technique to provide extended radicality comparable to that of a type III radical hysterectomy with the idea that it may reduce long-term lateropelvic recurrences. However, the more radical the hysterectomy, the more side effects on bladder and bowel function. In recent years, attention has been paid to this matter, and laparoscopic nervesparing surgical techniques have been developed by Querleu and associates to reduce these side effects. However, this extensive paracervical and parametrial dissection is of limited value in patients with small lesions (measuring <2 cm), as the risk of lateropelvic recurrence is low.

LAPAROSCOPICALLY ASSISTED RADICAL VAGINAL TRACHELECTOMY (DARGENT PROCEDURE)

History





In 1987, Dargent proposed a modification of the Schauta-Amreich radical vaginal hysterectomy to preserve the body of the uterus and thus the reproductive function. The procedure, the radical vaginal trachelectomy, today known as the *Dargent procedure*, implies the removal of the cervix along with the proximal portion of the parametrium and is preceded by a complete laparoscopic pelvic lymph node dissection. After nearly three decades, the accumulating experience worldwide summarized by Plante and coworkers suggests that the oncologic outcomes with this conservative procedure are comparable to those obtained following a radical hysterectomy for similarly sized lesions. Obstetrical outcomes are also very encouraging.

Indications

Eligibility criteria for this conservative procedure were initially proposed by Roy and Plante in 1998 and, for the most part, have remained unchanged.

1. Desire to preserve fertility
2. No clinical evidence of impaired fertility (relative contraindication)
3. Lesion size lesser or equal to 2 cm
4. FIGO stage IA1 with presence of vascular space invasion, IA2 and IB1
5. Squamous cell or adenocarcinoma
6. No involvement of the upper endocervical canal as determined by colposcopy or MRI
7. No metastasis to regional lymph nodes

The procedure can be offered to women older than age 40, understanding that the fertility potential is obviously reduced, or to women who already have children, as they may wish to have more children in the future. Sonoda and colleagues reviewed the Memorial Sloan Kettering Cancer Center experience over the course of 10 years and noted that 43% of their patients who underwent a radical hysterectomy for early-stage cervical cancer were younger than 40 years old; of those, 48% would have met the eligibility criteria for a radical trachelectomy. Therefore, a substantial proportion of young women with cervical cancer are potential candidates for this fertility preservation alternative.

Technique

The technique described in this chapter is based on the original technique developed by D. Dargent with modifications by M. Roy. The laparoscopic part of the procedure is identical to that of the Schauta, except that the uterine arteries are obviously not excised. The first three steps of the vaginal part of the surgery are also identical to the Schauta operation (vaginal cuff preparation, anterior phase, and posterior phase). The initial part of the lateral phase—that is, excision of the parametrium—is also identical; however, only the descending branch of the uterine artery is excised. The excision of the trachelectomy specimen and closure also differ from the Schauta operation and will be detailed here.

Lateral Phase (Described for the Patient's Left Side)

Ligation of the Cervicovaginal Artery

As opposed to the Schauta operation, in which the uterine artery is clamped at (*Print pagebreak 1235*) its origin, pulled down, and unroofed from under the ureter, the cross of the uterine artery is actually preserved in the case of a trachelectomy to maintain optimal vascularization of the uterus in the event of a future pregnancy. Therefore, only the cervicovaginal or descending branch of the uterine artery is excised. So, after precise localization of the isthmus and the cross of the uterine artery, the cervicovaginal artery is clamped with a right angle clamp placed at 90 degrees and directly applied to the isthmus ([Fig. 51.48](#)); then it is sectioned and ligated.



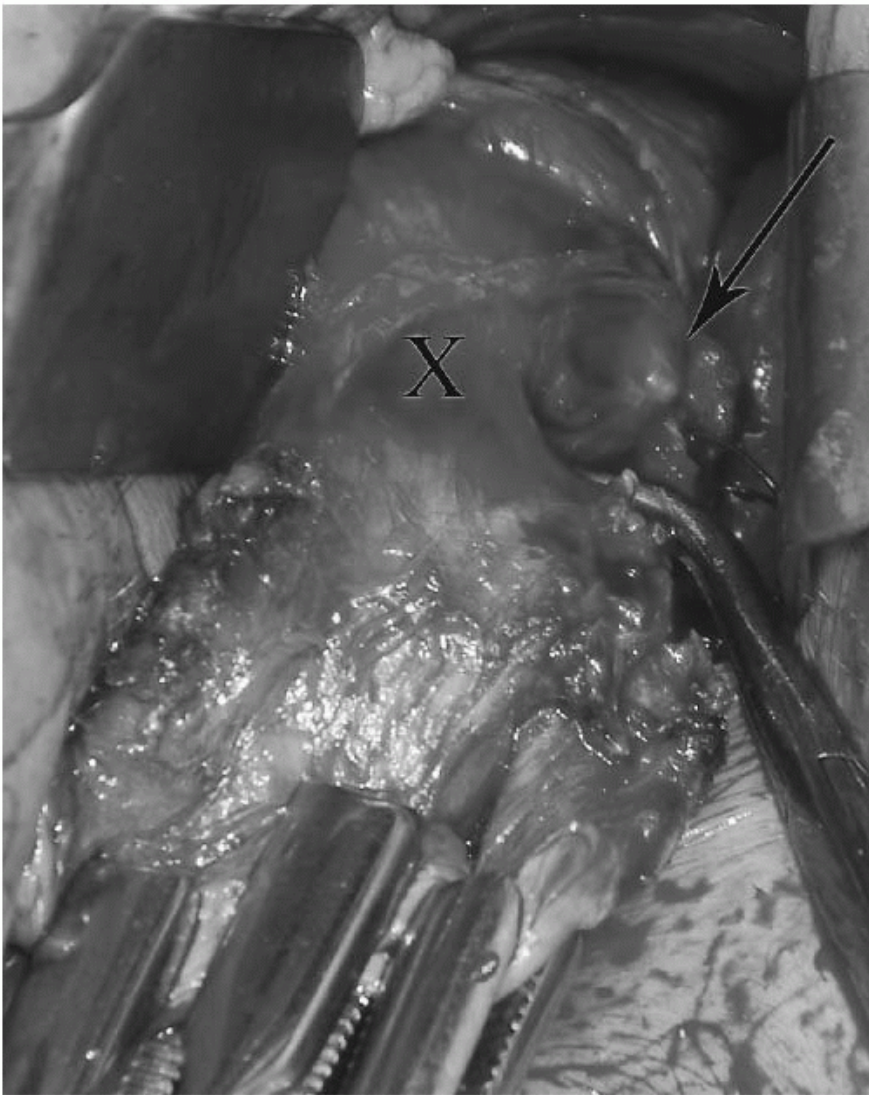


FIGURE 51.48 A clamp is applied just under the arch of the left uterine artery (*arrow*). The uterine isthmic area is visible (*X*).



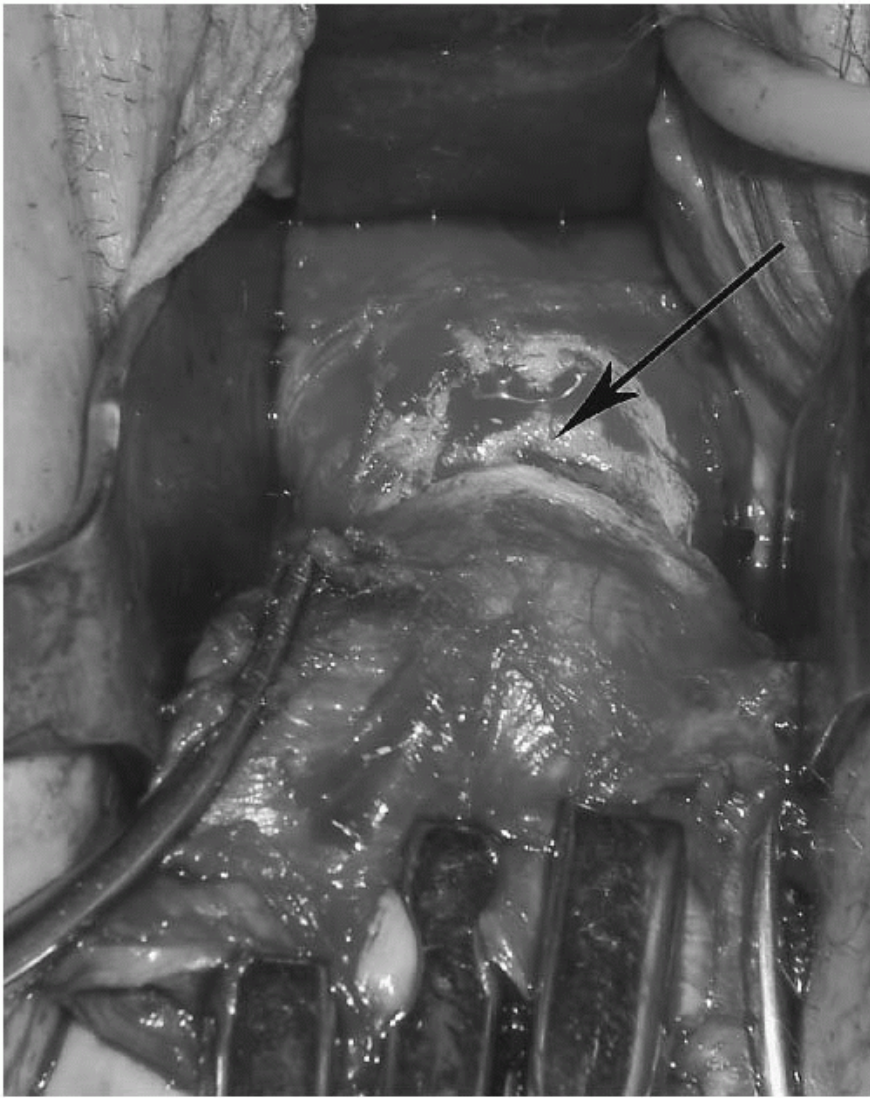


FIGURE 51.49 Section of the cervix 1 cm below the isthmus. The endocervical canal is visible (*arrow*).

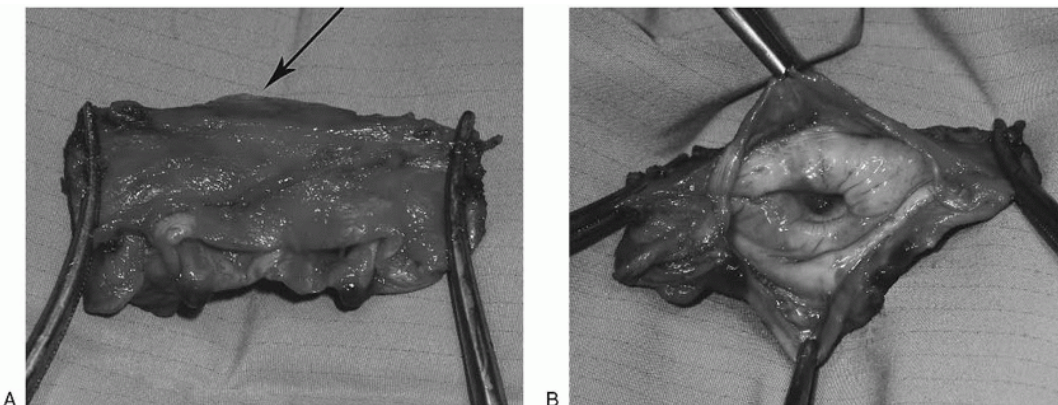


FIGURE 51.50 A, B: The specimen with its parametrium. The superior endocervical canal is shown (*arrow*).

Excision of the Specimen and Closure

The uterine isthmus and endocervix are precisely located by palpating the uterus anteriorly and posteriorly. The cervix is amputated with a scalpel held perpendicular to the specimen about 1 cm distal to the isthmus ([Fig. 51.49](#)). As the specimen is excised, the cervical os appears gradually, and the anterior lip can be grasped with a straight Kocher clamp. Care is taken not to angulate the scalpel to avoid removing too much cervix posteriorly. The specimen is completely excised in one piece to facilitate the pathologic evaluation of the margins.





(Print pagebreak 1236)

Ideally, the specimen should be at least 1 to 2 cm wide, with 1 cm of vaginal mucosa and 1 to 2 cm of parametrium ([Fig. 51.50A, B](#)). When there is no clinical evidence of residual tumor, a frozen section analysis is not performed. The specimen is kept intact for final analysis and will be processed as a cone specimen. However, in patients with a visible lesion, the trachelectomy specimen is sent for immediate frozen section analysis to assess the level of the tumor in relation to the endocervical resection margin. At least 8 to 10 mm of tumor-free tissue should be obtained between the level of the tumor and the endocervical resection margin; otherwise, additional endocervix should be removed or the trachelectomy should be completed by a radical vaginal hysterectomy (Schauta). It is thus extremely important to ask the pathologist to do a frozen section analysis of the cervix with a section made longitudinally from the ectocervix to the endocervix to evaluate the distance between the most cephalad edge of the tumor and the endocervical resection margin. A permanent cerclage is placed at the level of the isthmus using a nonresorbable Prolene or Ethibond 0 suture starting posteriorly at 6 o'clock to have the knot lying posteriorly. The sutures should not be placed too deeply into the cervical stroma, as the cerclage can eventually erode into the endocervical canal and be expelled. When tying the cerclage knot, a uterine probe can be placed in the cervical os to avoid tightening the knot too much, as this may cause cervical stenosis ([Fig. 51.51](#)).

The Dargent procedure is completed by reapproximating the edges of the vaginal mucosa to the new exocervix. This is accomplished with interrupted figures-of-eight sutures of 2-0 Vicryl. It is easier to begin with the sutures at 12 and 6 o'clock first. The lateral sutures are then placed separately to include the anterior and posterior vaginal mucosa only. Although easy to do, the closure of the vaginal mucosa is an extremely important step of the procedure, and care should be taken not to bury the cervical opening into folds of redundant vaginal mucosa ([Fig. 51.52](#)). The new exocervix should remain accessible for monitoring with colposcopic examination and cytology.

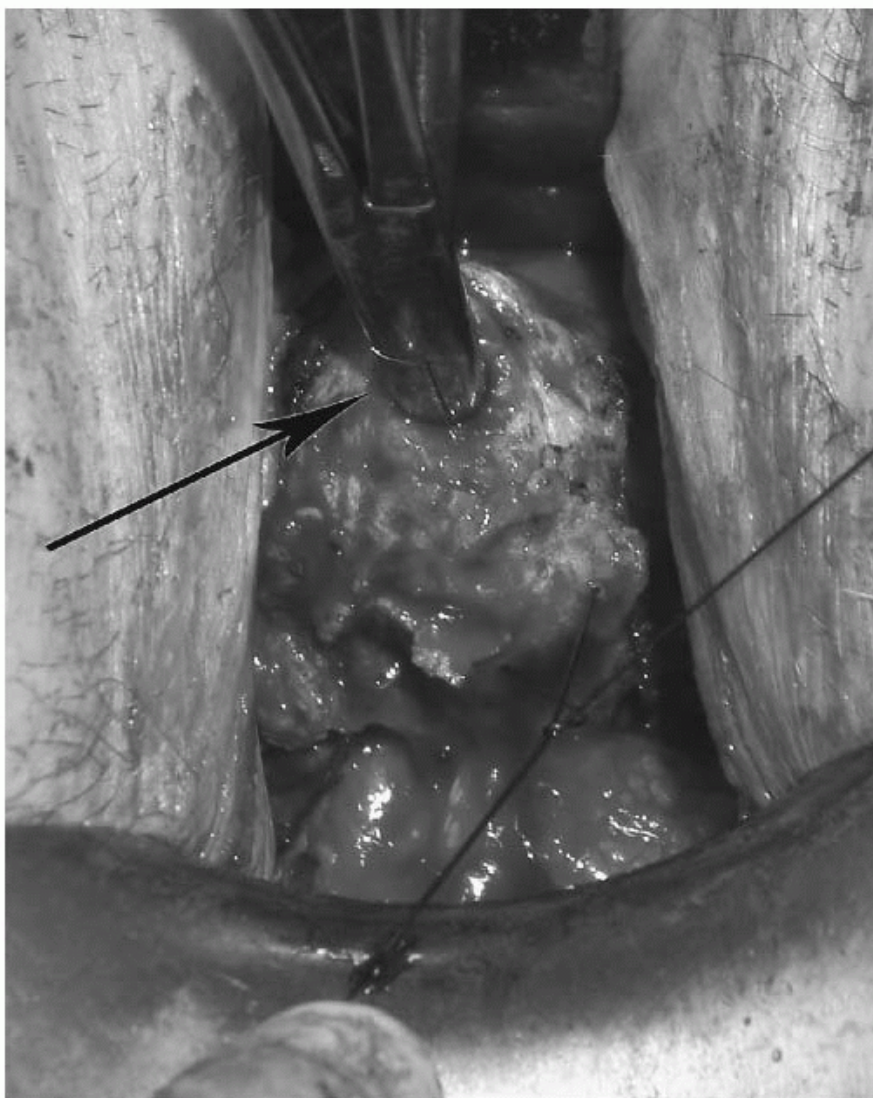


FIGURE 51.51 A cerclage is put in place and ligated posteriorly with a dilator (*arrow*) in the cervical canal.



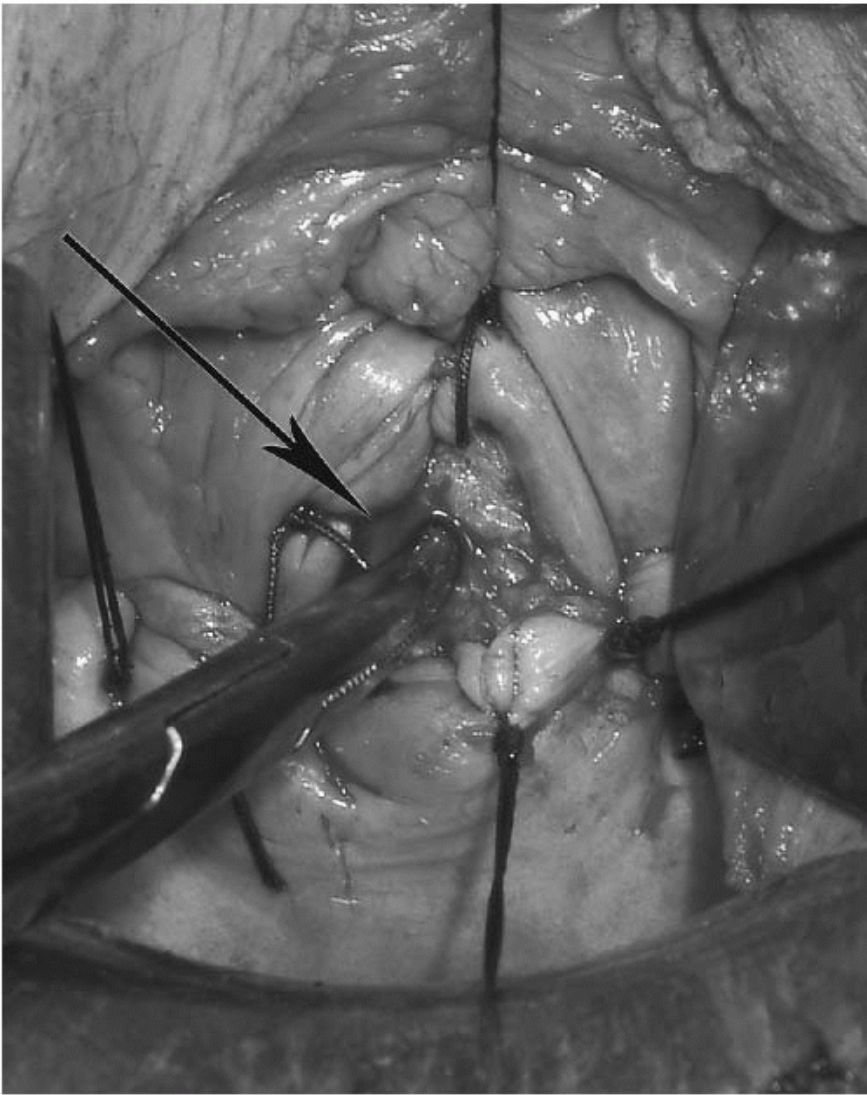


FIGURE 51.52 Suturing the vaginal mucosa to the cervical stroma. A clamp (*arrow*) indicates the endocervical canal.

At the end of the trachelectomy procedure, laparoscopy is performed to verify hemostasis in the pelvis and the integrity of the pelvic structures. No drains or packings are left.

Oncologic Outcome of Radical Trachelectomy

Data are accumulating worldwide indicating that the oncologic outcome following the radical trachelectomy is comparable to the outcome following a radical hysterectomy for similar-sized lesions. It should also be emphasized that adenocarcinoma histology and the presence of LVSI are NOT contraindications to offer or consider a fertility-sparing approach. Indeed, several large series consistently report a large percentage of adenocarcinoma cases with LVSI and a recurrence rate of less than 4% and a death rate of less than 2% ([Table 51.8](#)). Plante and colleagues have noted that the size of the lesion (≥ 2 cm) and the presence of LVSI seem to be the most important risk factors for recurrences. The recent work of Hertel and coworkers also suggests that adenocarcinomas may carry a higher risk of recurrence, but this is not uniformly agreed upon.

Morice and associates noted unusual sites of recurrences, such as in the vesicovaginal septum and in the bladder, which suggests that very meticulous surgical technique should be observed to avoid entering the wrong planes of dissection and (*Print pagebreak 1237*) potentially disseminating tumor cells at the time of the procedure. Piketty recently reported a recurrence in the ovary in a patient with an adenocarcinoma. Few recurrences have been reported on the residual cervix itself. The first, which occurred nearly 7 years following the initial surgery, was reported by Bali. It is unclear, however, whether it was a recurrence or a new primary. The other was reported by Bader and coworkers; it occurred 6 months after an abdominal trachelectomy and was picked up on a routine Pap smear. A radical hysterectomy was performed and disclosed a 3-mm recurrence (or persistence) in the cervix.

TABLE 51.8 Oncologic Outcome Postradical Trachelectomy





AUTHORS	NUMBER	RECURRENCES	DEATHS
Plante and Roy	100	2 (2.0%) ^a	1 (1.0%)
Covens and Steed	121	7 (5.8%)	4 (3.3%)
Shepherd et al.	112	3 (2.7%)	2 (1.8%)
Hertel et al.	100	4 (4.0%)	2 (2.0%)
Dargent and Mathevet	95	4 (4.2%) ^a	3 (3.1%)
Ungar et al. ^b	91	2 (2.2%)	0
Diaz	40	1 (2.5%)	1 (2.5%)
Wethington	101	4 (4%)	0
Total	760	27 (3.5%)	13 (1.7%)

^aExcluding one case of neuroendocrine tumor. ^bAbdominal radical trachelectomy.

Ungar and associates and del Priore and colleagues reported two recurrences following the abdominal radical trachelectomy procedure, and both were in patients with bulky lesions: One had a 3.8-cm lesion, and she recurred within 4 months of the surgery with a 6-cm lesion; the other had a 5-cm glassy cell adenocarcinoma and recurred 14 months after surgery. Strict selection criteria are extremely important to lower the risk of recurrences. Further experience will determine if the abdominal radical trachelectomy is safe in bulky lesions. Another alternative for patients with larger lesions is the use of neoadjuvant chemotherapy to reduce the size of the tumor followed by a fertility-preserving radical trachelectomy. Plante and coworkers have recently published their preliminary experience with three cases. All have had a complete pathologic response to the chemotherapy with no residual cancer in the surgical specimen. Obviously, this approach is currently experimental, but it has potential merits and deserves further investigation.

Shepherd recommends regular follow-ups after trachelectomy, including a colposcopic examination, cytology, and rectovaginal examination every 3 to 4 months for the first 2 to 3 years, every 6 months for the next 2 years, and yearly thereafter. Unfortunately, colposcopy and cytologies are frequently unsatisfactory after trachelectomy because the squamous columnar junction is often not visualized and the cytology frequently contains only squamous cells. Conversely, atypical glandular cells from the lower uterine segment are commonly picked up on the smear and misinterpreted as suspicious for recurrence. Singh and coworkers reported their experience with nearly 200 smears posttrachelectomy and concluded that a high proportion of the smears were unsatisfactory; 2% of the smears were reported as suspicious and, in fact, represented atypical endometrial cells, but two patients recurred and retrospectively had abnormal smears long before the recurrence was diagnosed. Reports of cytology posttrachelectomy should thus be interpreted with caution. Shepherd and coworkers recommend the use of an endocervical cytobrush for the cytology and an MRI at 6, 12, and 24 months postsurgery. The superb work by Sahdev and associates emphasizes the fact that radiologists interpreting those MRIs should be very well aware of the anatomical changes posttrachelectomy, as some of the changes may be misinterpreted as cancer recurrences.

Obstetric Outcome

The collected data on obstetric outcome are also very promising. As seen in [Table 51.9](#), there have been hundreds of pregnancies reported from the same groups of investigators, mostly with the vaginal but increasingly with the abdominal approach. In general, the rate of first-trimester miscarriage does not seem to be higher than in the general population, at approximately 16%. It is interesting to note that even though women undergoing a radical trachelectomy do so to preserve their fertility, there is a surprising 4% rate of elective pregnancy termination. The rate of second-trimester losses is higher than in the general population (8%). Overall, 66% to 75% of all pregnancies reach the third trimester. Of those, approximately 15% will end with significant prematurity at less than 32 weeks of gestation. Luckily, less than 10% will deliver before 28 weeks, when most of the severe neonatal morbidities and mortalities occur. Of note, multiple pregnancies appear to be at a particularly high risk of severe prematurity posttrachelectomy, and this should be taken into consideration when discussing in vitro fertilization in patients with infertility. Overall, 85% of the pregnancies reaching the third trimester will evolve normally beyond 32 weeks, and the majority will actually deliver at term (>37 weeks of gestation). The work of Klemm and colleagues suggests that there is no evidence that birth weight of newborns delivered from women who had a trachelectomy is lower. They showed that the vascular flow to the uterine artery before and after vaginal trachelectomy is well preserved.

The etiology of the second-trimester losses and the preterm deliveries is considered mechanical and/or infectious. Indeed, the short cervix probably does not offer as much support to the lower uterine segment. As the uterus enlarges and gets heavier, the cervix is more likely to dilate prematurely. However, the main etiology is felt to be infectious. Indeed, the shortened cervix after the trachelectomy procedure seems to prevent the formation of an efficacious mucus plug. The mucus plug is thought to play an important role as a physiologic barrier between the vaginal flora and the membranes to prevent ascending infections. Hence, the subclinical chorioamnionitis is thought to be responsible for the premature rupture of membranes and premature labor. Plante and associates proposed some guidelines for the follow-up of these high-risk pregnancies. A consultation with a specialist in fetal-





maternal medicine is recommended. The value of prophylactic antibiotic coverage—as well as steroid injections to accelerate fetal lung maturity near term—is unclear, although Shepherd and colleagues strongly recommend it. The work of Berghella and coworkers showed that serial transvaginal ultrasound is the best modality for the follow-up of cervical length in the general obstetric (*Print pagebreak 1238*) population and has been used in the follow-up of pregnant women posttrachelectomy. If the pregnancy evolves normally, delivery is planned at 38 to 39 weeks of gestation. Because of the permanent cerclage, women should be delivered by elective cesarean section.

TABLE 51.9 Obstetrical Outcome Post-Radical Trachelectomy

AUTHOR	PREGNANCY	T-1 ^a MISCARRIAGE	T-2 MISCARRIAGE	T-3 DELIVERY	DELIVERY <32 WK	DELIVERY >32 WK
Plante and Roy	59	10 (16%)	3 (4%)	2 (5%)	44 (75%)	3 (7%)
Dargent and Mathevet	56	11 (18%) ^c	3 (5%)	8 (14%)	34 (61%)	5 (15%)
Shepherd et al.	52	15 (29%)	2 (4%)	7 (13%)	28 (54%)	7 (25%)
Covens and Bernardini	45	8 (16%)	0	3 (7%)	34 (77%)	6 (18%) ^d
Hertel et al. ^e	14	1 (7%)	2 (14%)	0	11 (78%)	3 (27%)
Ungar et al. ^f	10	4 (40%)	0	0	6 (60%)	1 (17%)
Kim et al.	27	1 (4%)	3 (11%)	3 (12%)	20 (74%)	0
Total	263	50 (19%)	13 (5%)	23 (9%)	177 (67%)	25 (14%)

^aT-1, first trimester; T-2, second trimester; T-3, third trimester.

^bTAB, therapeutic abortions.

^cIncludes two ectopic.

^dIncludes 6 sets of twins.

^ePersonal communication, April 2006.

^fAbdominal radical trachelectomy.

Outcomes of pregnancy following an abdominal trachelectomy also appear promising. Although the numbers are smaller, Ungar and coworkers reported 10 pregnancies, with results comparable to pregnancies after the vaginal approach. There was concern that ligating the uterine arteries at the time of the procedure might have an impact on the vascularization of the uterus and potentially lead to intrauterine growth retardation. So far, the data seem reassuring in that regard, particularly after a recent publication by Wethington of an international series of abdominal trachelectomy with robust fertility outcomes, similar to those of the vaginal approach.

Conclusion

Based on the collected data available, the radical trachelectomy truly offers a valuable alternative to young women with small, early-stage cervical cancer who wish to preserve their fertility. Oncologic outcomes are comparable to standard radical hysterectomy for similar-sized lesions, and the complication rate is low. Pregnancies are possible after this procedure, and overall obstetrical outcome is good despite the rate of second-trimester loss and premature delivery. In the last three decades, there has been a tremendous shift toward minimally invasive surgical techniques in gynecologic oncology. Laparoscopic, robotic, and radical vaginal/abdominal fertility-sparing surgeries have revolutionized the surgical management of cervical cancer. The radical trachelectomy (Dargent operation) is unquestionably the most important surgical development in the treatment of early-stage cervical cancer in the last century. Importantly, in 2013, the NCCN cervical cancer management guidelines began dedicating a full panel for the surgical treatment options of women with stage IA1-IB1 cervical cancer who wish to preserve fertility and included a conization or trachelectomy as a standard of care in select women.

TOTAL LAPAROSCOPIC AND ROBOTIC RADICAL HYSTERECTOMY WITH LYMPHADENECTOMY

Laparoscopic radical hysterectomy with pelvic and aortic lymph node dissection was first reported by Nezhat in 1992. This technically challenging procedure initially was received with caution by gynecologic oncologists who have used the abdominal





radical hysterectomy as the traditional approach for decades. So far, there have not been any reported randomized trials to compare these two surgical approaches; however, such a trial is currently ongoing, and there have been hundreds of reported cases worldwide, with encouraging results. Well-recognized, pioneer work was undertaken by Spirtos and associates, who described 78 consecutive patients, all with early cervical cancer and a Quetelet body mass index less than 35, who underwent the procedure. In all, 94% of the procedures were completed laparoscopically, with an average operative time of 205 minutes and an average blood loss of 225 mL, with only one patient (1.3%) requiring transfusion. There was one ureterovaginal fistula documented. The average lymph node count was 34, with 11.5% of patients having positive lymph nodes. Three patients (3.8%) had close or positive surgical margins, and 5.1% recurred with a minimum of 3 years of follow-up. [Table 51.10](#) summarizes reports on laparoscopic radical hysterectomy with pelvic and aortic lymphadenectomy.

(Print pagebreak 1239)

TABLE 51.10 Summary of Initial Reports on Laparoscopic Radical Hysterectomy and Lymphadenectomy

AUTHOR	N ^a	PLN	ORT (MIN)	EBL (ML)	LOS (DAYS)	COMPLICATIONS	CURRENT STATUS
Nezhat et al. (1992, 1993)	7	22	315	30-250	2.1	None	None
Sedlacek et al. (1994, 1995)	14	16	420	334	5.5	1 VVF, 1 ureteral injury	—
Ting (1994)	4	8	330-480	150-500	—	None	—
Osterzenski (1996)	6	—	280	—	2-6	1 hydronephrosis	—
Spirtos et al. (1996)	10	18.3	253	300	3.2	None	—
Kim and Moon (1998)	18	22	363	619	—	None	—
Hsieh et al. (1998)	8	—	—	—	6.5	None	1 distant
Spirtos (2002)	78	23.8	205	250	2.9	1.3% transfusion, 3 cystotomies, 1 UVF, 1 DVT 5 conversions	8 (10.3%)
Lee (2002)	12	19.2	235	428	6.8	2 transfusion	None at 1 y
Lin (2003)	10	—	—	250	4.1	None	—
Obemair (2003)	55	—	210	200	5	3 vascular, 1 nerve, 1 fistula	None
Pomel (2003)	50	13.2	258	—	7.5	1 bladder fistula, 1 ureter stenosis	5-y survival 96%
Abu-Rustum (2003)	19	25.5	371	301	4.5	1 transfusion, 2 conversion, 1 fever	None
Gil-Moreno (2005)	27	19.1	—	400	5	—	None

^aSome patients may be reported more than once.

N, number of patients; PLN, mean pelvic lymph nodes; ORT, mean operating room time; EBL, mean estimated blood loss; LOS, mean hospital stay; VVF, vesicovaginal fistula; UVF, ureterovaginal fistula; DVT, deep venous thrombosis.

Total Laparoscopic or Robotic Radical Hysterectomy

One technique of the laparoscopic radical hysterectomy is well described by Spirtos and associates and Chen and colleagues. The laparoscopic approach uses different surgical instruments and techniques than the classic approach to accomplish the same procedure performed via laparotomy. The technique of laparoscopic radical hysterectomy described in this section relies on the use of the monopolar electrosurgical devices and vessel-sealing instruments or bipolar traditional graspers. The robotic platform brought much improvement in ergonomics and visualization and helped popularize the use of laparoscopy in radical hysterectomy, but the





energy sources and technology remain similar to the laparoscopic counterpart and all pneumoperitoneum-based surgery. Four to six trocars are needed, with the camera near the umbilical site. The retroperitoneum is opened and the round ligaments coagulated. The paravesical and pararectal spaces are developed with monopolar devices, and the ureter is clearly identified. Resection of the adnexa is managed on an individual basis as per the open approach. The uterine artery is identified after developing the pararectal and paravesical spaces, and the umbilical ligament is isolated. The uterine artery and vein are sealed and divided. The bladder flap is then developed. The posterior cul-de-sac peritoneum is incised and the rectouterine ligaments exposed. The ureter is then unroofed from the parametria by placing medial traction on the stapled uterine artery stump, and the bladder is dissected further inferiorly. The uterosacral/rectouterine ligaments are divided, and the ureter is retracted laterally to resect the desired length of parametria. Anterior colpotomy is performed at the desired vaginal length. A vaginal probe facilitates stretching the vagina for easier incision. The remaining parametria and paracolpos are resected with monopolar devices. The specimen is removed vaginally with a single-tooth tenaculum, and the vaginal cuff is closed laparoscopically with endoscopic sutures. The placement of ureteral catheters or stents to facilitate ureteric manipulation is optional. The pelvic and aortic lymphadenectomy is performed, as described. Pelvic drains usually are not necessary, and a suprapubic catheter is optional.

(Print pagebreak 1240)

LAPAROSCOPIC SURGICAL STAGING

Currently available clinical staging methods and imaging studies are not completely accurate in the detection of pelvic and aortic lymph node metastasis from cervical cancer, and pathologic evaluation of retroperitoneal lymph nodes remains the gold standard for establishing metastasis. In addition, identifying retroperitoneal nodal metastasis may alter the overall therapeutic approach and affect the patient's prognosis.

Laparoscopic surgical staging with pelvic and aortic lymph node dissection for cervical cancer was initially reported by Querleu in France. Since that initial report, many investigators have adopted the laparoscopic pretreatment surgical approach and continue to modify the technical details of the procedure. It is well established at this point that transperitoneal or extraperitoneal laparoscopic pelvic and aortic lymph node dissection for cervical cancer, in experienced hands, is feasible, yields similar results as the open approach, and is associated with low morbidity. Furthermore, this approach may provide valuable information that is not available using clinical staging techniques. Computed tomography was able to detect retroperitoneal nodal metastasis in only 17% to 57% of cervical cancer patients staged laparoscopically. [Table 51.11](#) summarizes selected reports on laparoscopic pelvic and aortic lymph node dissection in the management of stage I to IV cervical cancer.

TABLE 51.11 Summary of Pretreatment Laparoscopic Pelvic and Aortic Lymph Node Dissection in the Management of Stage I to IV Cervical Cancer

AUTHOR	N	STAGE	PLN (% +)	PAN (% +)	ORT	HD	COMPLICATI
Querleu (1991)	39	IB-IIB	8.7 (12.8%)	—	90	1	3 minor
Childers (1993)	18	IB-IVA	31.4 (both) (33.3%)	(6.2%)	75-175	1.5	Not significant
Fowler (1993)	12	IB	23.5 (16.7%)	6.5 (0%)	373 With laparotomy	7.4 With laparotomy	2 minor
Su (1995)	38	—	15	—	77	—	1 vascular 1 Ureteral
Recio (1996)	12	IB2	18 (25%)	7 (0%)	176	1	Not significant
Chu (1997)	67	IA2-IIIB	26.7 (12.8%)	8 (35.7%)	93	2	1 vascular
Possover (1998)	26	IIB-IIIB	15.3 (11.5%)	6.8 (7.7%)	162	3.2	1 vascular
Vidaurreta (1999)	84	IB2-IV	18.5 (45.2%)	—	108	1-2	1 vascular
Schlaerth (1999)	40	IA-IIA	32.1	12.1	—	—	—
Querleu (2000)	53	≥IB2	With common iliac	20.7 (32%)	126	1-2	1 ureteral
Altgassen (2000)	108	IA1-IVB	21-24.3	5.1-10.6	Aortic: 35-73 Pelvic: 61-70	—	3 vascular





11 reports	497	I-IV	9-32 (24%-25%)	6-21 (19%-20%)	120	1-2	1%-2% vascular 0.4% ureteral
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HD, mean hospital stay in days; *N*, number of patients; ORT, mean operating room time in minutes; PAN, mean aortic lymph nodes; PLN, mean pelvic lymph nodes.

Laparoscopic Surgical Staging Technique

The technique of laparoscopic surgical staging continues to evolve as experience with this minimally invasive approach increases; the introduction of the robotic approach has added to this evolution, although the principles of this procedure are similar to those of the laparoscopic approach, except whether the nodes are approached transperitoneally or extraperitoneally. Therefore, these are the two main approaches: the transperitoneal approach and the extraperitoneal approach (popularized by Querleu and Dargent from France). For the transperitoneal approach, four laparoscopic trocars usually are needed ([Fig. 51.53](#)): 10-mm trocars in the umbilical and suprapubic regions and 5-mm trocars just medial to the iliac crest on each side. For the aortic nodal dissection, the laparoscope is placed in the suprapubic region, and the monitors are moved cephalad. For the pelvic lymphadenectomy, the laparoscope is placed in the umbilical region, and the monitors are placed caudal. A variety of endoscopic tools may be used with similar results. The selection usually is based on the surgeon's preference and experience. Both monopolar and bipolar currents are available, and a wide variety of endoscopic dissecting instruments, clip applicators, and specimen retrieval devices are available. A retroperitoneal nodal dissection may be satisfactorily completed in the majority of cases with the aid of a tissue grasper and an endoscopic clip applicator or vessel-sealing device. (*Print pagebreak 1241*) The right aortic nodal tissue is approached via a retroperitoneal incision over the right common iliac artery. The right ureter and ovarian vessels are identified, and the nodal tissue over the inferior vena cava is removed. The left aortic nodal tissue may be approached via the same incision. The inferior mesenteric artery, left ureter, and left ovarian vessels are identified, and the nodal tissue over the left aortic region is removed.

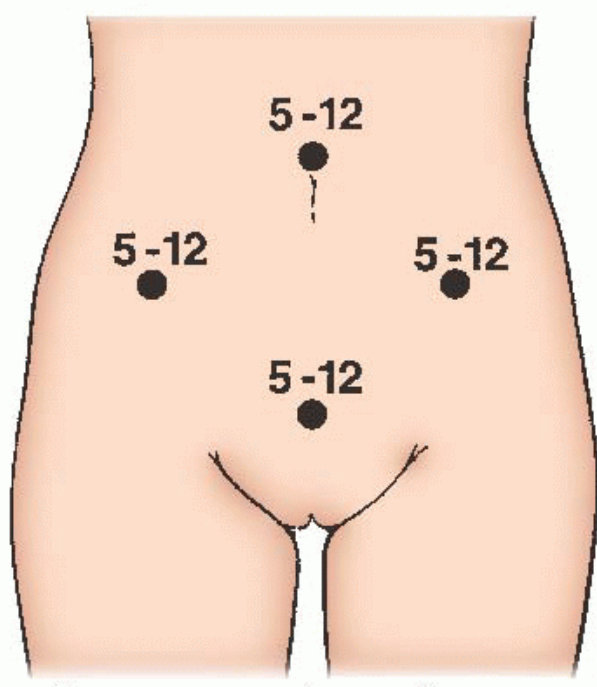


FIGURE 51.53 The transperitoneal minimally invasive approach for laparoscopic surgical staging. Four laparoscopic trocars usually are needed. (Figure © MSKCC, 2002.)

Dissection above the inferior mesenteric artery to include the infrarenal nodal regions may be accomplished through a similar approach, and a left-sided laparoscopic suprarenal retrocaval paraaortic lymphadenectomy in advanced cervical cancer has been described, but the resection of infrarenal aortic nodes using the transperitoneal approach is technically challenging, particularly in obese patients. Robotics may improve on the popularization of paraaortic minimally invasive lymphadenectomy.

PATHOLOGIC EXAMINATION OF THE OPERATIVE SPECIMEN

Considerable useful information about the extent of the disease can be obtained by a careful pathologic examination of the operative specimen. This is helpful in determining prognosis but is also absolutely essential to the identification of patients at greater risk for persistent disease so that additional therapy and close surveillance can be provided. Even though the operator may be fatigued at the end of the operation, in cases where there is a major critical decision based on the specimen, the surgeon should consider





accompanying the specimen to the pathology laboratory, where it can be examined with the pathologist before it is placed in fixative and sectioned. Another alternative is to call the pathologist to the operating room for a joint examination of the specimen while the surgical incisions are being closed. The gynecologic surgeon then can indicate worrisome parts of the specimen; such information assists the pathologist in taking sections. Critical margins of dissection can be pointed out and stained with India ink so that they can be seen on microscopic slides. The primary cervical tumor should be measured as accurately as possible so that at least an estimate of its size and volume can be recorded. Numerous microscopic sections of the cervix with adjacent vaginal cuff; lower uterine segment; and paravaginal, paracervical, and parametrial tissue should be examined to show the cell type, degree of differentiation, depth of stromal invasion, and presence or absence of invasion of lymphatic and vascular spaces. It is important to know not only the depth of invasion but also the thickness of the uninvolved fibromuscular stroma of the cervix, as pointed out by Kishi and coworkers. These authors found that the nodal metastasis and 5-year cancer death rates were 7% and 8%, respectively, in patients with uninvolved fibromuscular stroma thickness greater than 3 mm, and 37% and 26%, respectively, in patients with thickness less than 3 mm. Furthermore, the GOG has demonstrated that the percentage of invasion of tumor into the cervical stroma is an independent prognostic factor and is used to help determine the need for postoperative adjuvant treatment.

Unfortunately, the exquisite giant section technique of pathologic examination used by Burghardt and coworkers is not available in any US pathology laboratory. These authors measured ratio of tumor size to the size of the cervix. The incidence of lymph node involvement increased with tumor size, reaching a maximum of 68.3% in the group with a ratio from 70% to 80% of cervical anatomic involvement. Surprisingly, direct spread into the parametrium seldom was found, even when large tumors were found to occupy the entire cervix. This finding is contrary to that of Bleker and coworkers, who found 16.8% unrecognized parametrial tumor involvement in patients with stage IB and IIA lesions. The 5-year survival rate fell with parametrial involvement.

Thorough examination of the lymphadenectomy specimens must be done. Tumor metastasis to lymph nodes affects patient survival adversely and is an indication for postoperative adjuvant therapy. In patients with positive nodes, the pathologic examination should report whether the metastatic disease is microscopic or macroscopic, single or multiple, and unilateral or bilateral. The location of lymph nodes positive for tumor also should be reported because the prognosis is especially poor in patients with positive common iliac or paraaortic nodes. The usual standard technique of pathologic examination of lymphadenectomy specimens involves removal of visible and palpable nodes from fatty tissue, with bisection of each node for microscopic examination. This standard technique may not be adequate for an accurate assessment of lymph node metastases. A significant increase in positive findings can be obtained if special pathologic examination techniques are used, as demonstrated by To and coworkers, Ahrens and Tschoke, and Wilkinson and Hause. With their technique of dissection of lymph nodes at multiple levels before paraffin embedding, To and coworkers showed that 9% of patients originally reported to have negative nodes actually had positive nodes.

An accurate assessment of the extent of disease by a careful pathology examination of the operative specimen is imperative in deciding whether additional treatment is needed. Indeed, it is such an important component in the surgical management of patients with cervical cancer that these patients should be operated on only in hospitals where such expert specimen evaluation is available.

POSTOPERATIVE COMPLICATIONS

Bladder

Neurogenic Dysfunction

A non-nerve-sparing radical hysterectomy substantially denervates the bladder and upper urethra; the more extensive the dissection, the greater the degree of interference with their function. Therefore, a type C1 nerve-sparing resection has (*Print pagebreak 1242*) been popularized. Parasympathetic and sympathetic nerve fibers to and from the bladder and urethra are removed, along with paracervical, paravaginal, cardinal ligament tissues and pelvic lymph nodes. All patients have some degree of bladder dysfunction; the incidence of significant bladder dysfunction can be as high as 50%.

Studies have demonstrated that the bladder initially can be hypertonic, with decreased bladder capacity, increased resting pressure, and increased residual urine volume. Many patients have difficulty initiating micturition and experience a loss of sensation of bladder fullness. Using sensitive urodynamic instrumentation, Scotti and coworkers found a variety of abnormalities, including obstructive voiding patterns, immediate and delayed loss of compliance, sensory losses, and genuine stress incontinence. Some patients had complete absence of bladder contractions during voiding. Although these findings are quite compelling, Lin and associates recently reported normal preoperative urodynamic findings in only 17% of 210 patients with cervical cancer scheduled to undergo radical hysterectomy.

Mundy and Sasaki and coworkers have suggested that the posterior part of the cardinal ligament (pars nervosa) contains the major part of the parasympathetic and sympathetic nerve supply to the bladder and urethra and that its removal is responsible for postoperative bladder dysfunction. Sasaki and coworkers demonstrated that removal of the anterior cardinal ligament (pars





vasculosa) with preservation of the pars nervosa reduces the incidence of postoperative bladder dysfunction. The work of Kadar and coworkers and that of Asmussen and Ulmsten suggests that the nerve supply to the bladder and urethra can be spared without compromising the necessary extensive dissection and tissue removal around the central disease, thus sparing many patients the loss of urethrovaginal function. Kuwabara and colleagues recently reported a decrease in bladder dysfunction by using a technique of intraoperative electrical stimulation to identify and preserve the vesical nerve branches. These nerve-sparing modifications have not been widely adopted by gynecologic oncologists in the United States because of a concern that this same cardinal ligament tissue also carries lymphatic channels draining the cervix and should be removed in a complete central dissection. However, Trimbos and colleagues, from the Netherlands, reported no increase in recurrence or decreased survival in a series of patients treated with nerve-sparing radical hysterectomy.

Techniques of managing the postoperative bladder have varied widely. Duration of catheter drainage, suprapubic versus transurethral drainage, the value of self-catheterization, and the value of cystometric studies have all been debated, as described by Bandy and coworkers. These authors also found that patients receiving postoperative adjunctive pelvic radiation had significantly more contracted and unstable bladders than patients treated with surgery alone. Proper management of the bladder in the first several weeks after operation is essential to avoid overdistention. The duration of postoperative bladder catheterization has decreased in recent years. Chamberlin and investigators reported a contemporary median indwelling catheter duration of 6 days compared with 30 days in historical controls, with no increase in complication rates.

Although some clinicians leave an indwelling catheter or suprapubic tube in place 2 to 3 weeks, we prefer continuous transurethral catheter drainage until 7 days after surgery. Early postoperative intravenous pyelography (IVP) in the absence of intraoperative urinary tract injury or clinical symptoms suggestive of injury is not indicated; moreover, an abnormal early IVP is not predictive of subsequent urinary tract dysfunction. When the catheter is removed, postvoid residuals are checked with a bladder ultrasound scan (transurethral catheterization also can be used). If the postvoid residual volume is below 50 to 75 mL and the volume of urine spontaneously voided is greater than the postvoid residual, then the patient is allowed to leave the hospital without an indwelling catheter. She must be thoroughly schooled in the importance of not allowing her bladder to become overdistended. Allowing the bladder to overdistend, especially in the early postoperative recovery period, can result in a flaccid bladder from stretching and decompensation of the detrusor muscle, prolongation of bladder dysfunction with high residual urine volumes, and the likelihood of urinary infections. Patients who have unacceptable postvoid residuals are best managed with intermittent self-catheterization or prolonged indwelling catheter drainage for several weeks before attempting removal. If a serious episode of overdistention of the bladder ever occurs, continuous indwelling catheter drainage should be reinstituted, sometimes for 1 to 2 weeks, with the hope that permanent impairment of bladder function can be avoided. Urinary tract infections can occur in conjunction with bladder dysfunction and should be looked for with periodic urinalysis and culture and treated with appropriate antibiotics. Patients should be encouraged to maintain a urine output above 2,000 mL per day to avoid urinary tract infection.

In most patients, a satisfactory voiding pattern can be established within several months. Urodynamic studies, however, can show some evidence of slight and persistent chronic bladder dysfunction for several years. Fraser stated that 20% of his patients continued to report changes in bladder sensation 5 to 15 years after operation. In many patients who have had properly performed radical hysterectomy and pelvic lymphadenectomy, it is inevitable that bladder function will never be completely normal again. With proper postoperative bladder care and rehabilitation, however, function should be satisfactory in most patients at the end of the first year. According to Fishman and coworkers, 35% of patients continued to express unhappiness at the extent and effect of their postoperative urinary dysfunction.

Vesicovaginal Fistula

In the absence of prior pelvic irradiation, bladder ischemia and vesicovaginal fistula are infrequent complications of this procedure. Vesicovaginal fistulae occur in less than 1% of patients ([Table 51.12](#)). Nearly one third of urinary tract fistulae following surgery heal spontaneously, compared with none if adjuvant radiation therapy is given. The management of vesicovaginal fistulae is discussed in [Chapter 39](#).

Ureter

Clark, working at the Johns Hopkins Hospital, published one of the first descriptions of radical hysterectomy for cervical cancer in 1895. Sampson, working in the same institution during the same time, recognized that injury to the ureter was the most serious problem associated with primary radical surgery for this disease. His publications on ureteral anatomy and blood supply and the relation between the ureter and gynecologic disease are classic and pertinent today. Devascularization and ischemic necrosis of the wall of the terminal ureter has proven to be one of the more serious complications of this operation. Wertheim found this complication to be one of the more serious sequelae. In Meigs's clinic, there was a 12.5% significant ureteral complication rate, including an 8.5% incidence of ureterovaginal fistulae and a 4% incidence of ureteral stricture.

(Print pagebreak 1243)





TABLE 51.12 Urinary Fistulae in Nonirradiated Patients Treated by Radical Abdominal Hysterectomy

INVESTIGATORS	NUMBER OF PATIENTS	URETERAL FISTULA (%)	VESICAL FISTULA (%)
Kaser et al. (1973)	717	3.3	0.6
Park et al. (1973)	156	0	0
Hoskins et al. (1976)	224	1.3	0.45
Morley and Seski (1976)	208	4.8	0.5
Sail et al. (1979)	349	2.0	0.8
Webb and Symmonds (1979)	423	1.4	0.7
Benedet et al. (1980)	241	1.2	0.4
Langley et al. (1980)	284	5.6	1.4
Lerner et al. (1980)	108	0.9	0
Bostofte et al. (1981)	479	3.8	1.4
Powell et al. (1981)	135	1.5	0
Zander et al. (1981)	1,092	1.4	0.3
Gitsch et al. (1984)	187	0.5	NS
Shingleton (1985)	444	1.4	0.23
Artman et al. (1987)	153	1.3	1.3
Larson et al. (1987)	233	0.8	NS
Ralph et al. (1988)	320	1.9	2.5
Lee et al. (1989)	954	1.2	1.2
Kenter et al. (1989)	213	3.3	3.3
Burghardt et al. (1989)	325	2.5	2.8
Massi et al. (1993)	228	0.9	0.4
Total	7,473	2.0	0.9

NS, no sample.

From Shingleton HM, Orr JW. *Cancer of the cervix: Diagnosis and treatment*. New York, NY: Churchill Livingstone, 1987:174, with permission of Elsevier.

For many years, gynecologic surgeons have attempted to lower the rate of ureteral complications with special techniques. Novak, from Yugoslavia, reduced the incidence of ureteral fistulae to 2% after primary radical surgery by placing the dissected pelvic ureter on the inside (peritoneal surface) of the pelvic peritoneum and by preserving the lateral mesentery to the terminal ureter. Green and coworkers suggested that the terminal ureter should be lifted out of the accumulated fluid in the retroperitoneal space by suturing it to the obliterated hypogastric artery. Ohkawa developed a procedure that attempted to elevate and isolate the ureter from the infected retroperitoneal fluid and also to develop a new blood supply to the terminal ureter by placing it in a peritoneal envelope from the pelvic brim to the bladder. Blythe and coworkers compared this technique with simple retroperitoneal suction drainage first advised by Symmonds and Pratt. They found that ureteral obstruction and ureterovaginal fistulae occurred twice as often and that the operative time was extended 45 minutes to 1 hour with the Ohkawa technique. More recently, Patsner and others have recommended the routine use of the omental J-flap (omentopexy) at the conclusion of radical hysterectomy and pelvic lymphadenectomy as an effective means of minimizing urinary tract fistulae.

Given a normal unirradiated ureter, we believe that the incidence of ureteral fistulae and permanent stenosis can be kept below 1% with meticulous intraoperative management of the ureter by a technically skillful operator who can prevent vascular trauma to the periureteral sheath and injury to the muscularis of the ureter.

(Print pagebreak 1244)

Some temporary postoperative changes in ureteral function are an almost inevitable result of radical hysterectomy, as pointed out by Gal and Buchsbaum. Using special static and cinefluoroscopic IVP techniques, these authors found ureteral dilation in 87% of patients in the first week after surgery. In most cases, by 6 weeks after surgery, the dilation had regressed and the pyelograms had returned to normal. Peristalsis was altered in the distal ureter, which appeared as a rigid conduit during the first postoperative week. Peristalsis had returned 1 month later. These changes may explain the increased frequency of urinary tract infections after radical hysterectomy, and the possibility of permanent ureteral stenosis if radiation, serious infection, or lymphocyst formation is superimposed.





[Table 51.12](#) shows the frequency of urinary fistulae in a collected series of 7,473 nonirradiated patients treated by radical hysterectomy as compiled by Shingleton and Orr. The management of ureterovaginal fistulae is discussed in [Chapter 39](#).

Lymphocyst Formation

Traditionally, a closed system of constant suction was placed in the retroperitoneal spaces on each side at the end of the procedure. These drains were thought to be effective for reducing the risk of pelvic infection, fistula, and lymphocyst formation. However, recent retrospective and prospective studies have demonstrated that the incidence of these complications is not decreased in patients who have retroperitoneal drains placed compared with those who do not. Furthermore, the drains may actually increase infectious complications. Therefore, we do not routinely place drains in the retroperitoneal spaces.

Whether drains are placed or not, a small percentage of patients will develop lymphocysts. A lymphocyst becomes obvious by symptoms and examination in the weeks after radical hysterectomy and pelvic lymphadenectomy. It may be small and asymptomatic. Most patients with large lymphocysts report lower abdominal discomfort on the same side with radiation to the back, hip, or thigh. Some edema of the lower extremity on the same side may be present and mistaken for postoperative chronic lymphedema due to nodal dissection, but it is more likely due to acute pressure obstruction of lymphatics with the large sidewall lymphocyst and may improve after cyst drainage. Evidence of ureteral obstruction may be found on IVP or CT urogram.

Small lymphocysts that do not cause ureteral obstruction can be observed without treatment. Large symptomatic lymphocysts and those that cause ureteral obstruction should be aspirated. CT-directed needle aspiration can be done with local anesthesia and repeated as needed. The fluid should be submitted for cytologic examination and culture. It is seldom necessary to perform open drainage of a lymphocyst. Mann and coworkers reported successful sclerosis of a recurrent lymphocyst by injection of a solution of tetracycline. Others have used povidone-iodine sclerosis.

Infection

Historically, patients were treated with antibiotics only if postoperative infection occurred. However, antibiotic prophylaxis has been associated with decreased febrile morbidity and decreased rates of serious infection in women undergoing radical abdominal hysterectomy. Furthermore, Orr and colleagues have demonstrated that a single dose of prophylactic antibiotic is as effective as a multiple-dose regimen and lessens patient exposure and cost. Thus, the prophylactic use of broad-spectrum antibiotics with both aerobic and anaerobic coverage has proved to be a useful addition to the surgical armamentarium.

We initiate single-agent broad-spectrum antibiotic coverage immediately before surgery. The administration of the drug is timed to allow adequate distribution before incision. During an extended operation, if the antibiotic given has a short half-life, a second dose is administered.

When secondary infection occurs despite the use of prophylactic antibiotics, the appropriate cultures are obtained, and bacteria-specific antibiotic therapy is chosen.

Venous Thrombosis and Pulmonary Embolus

Patients who undergo radical pelvic surgery fulfill the components of Virchow's triad and are at high risk for the development of venous thrombosis of the lower extremities and thromboembolic phenomena. Factors such as postoperative alteration of blood coagulation, trauma to the vein wall, and venous stasis are recognizable features of this type of surgery. In particular, pelvic lymphadenectomy invariably produces some trauma to the vein wall during the mobilization of the vessel and resection of the adherent lymphatic tissue. One of the biologic effects of radical surgery is the occurrence of local tissue necrosis during healing. This results in the release of tissue thromboplastin into the circulation, which contributes to venous thrombosis by acceleration of the clotting mechanism. The release of thromboplastin from the intima of the vein wall also provides an excellent nidus for the formation of fibrin, particularly in an area of the venous system where there is alteration in venous flow with stagnation of blood. This is frequently seen behind the valves of the veins of the lower extremity, where silent thrombosis is common. Prolonged immobilization of the lower extremities during a lengthy operative procedure is responsible for intraoperative venous stasis and clot formation. There is evidence to document that postoperative thrombosis of the lower extremity is a result of the surgical procedure in more than 50% of cases. The prevention, diagnosis, and treatment of venous thromboembolic events are extensively discussed in another chapter.

Efforts to decrease the frequency of this complication initially used prophylactic low-dose heparin, 5,000 U subcutaneously, three times daily, beginning 2 hours before surgery, and given every 8 hours thereafter for the subsequent 5 postoperative days. By using perioperative heparin alone, the incidence of deep vein thrombosis in a study by Kakkar and associates was decreased from 24.6% in the untreated control group to 7.7% in the heparin-treated group of surgical cases. More impressive was the observation in a subsequent study by the same investigators that 16 patients in the control group, compared with only 2 patients in the heparin-





treated group, were found on autopsy study to have died of acute, massive pulmonary embolism.

We use intermittent pneumatic calf compression beginning in the operating room and continuing whenever the patient is in bed until she is discharged. These compression boots are used not only in our patients undergoing radical hysterectomy but in all our patients undergoing major gynecologic surgical procedures. In very high-risk patients, we add prophylactic low molecular weight heparin.

Approximately 3% to 5% of patients with occult venous thrombosis of the lower extremities develop pulmonary emboli. Unfortunately, more than half of the cases of fatal pulmonary embolism occur in patients with silent venous thrombosis and without any clinical evidence of this complication before the acute pulmonary catastrophe. When evidence of *(Print pagebreak 1245)* venous thrombosis of the lower extremity is verified, full anticoagulation therapy is required for prevention of pulmonary embolism. However, the decision about how soon after radical surgery it is safe to fully anticoagulate a patient may be very difficult. In the rare case that a pulmonary embolus occurs after full anticoagulation has been achieved, it is necessary to prevent further migration of clot to the lung by either inferior vena cava ligation or the use of an intracaval Silastic umbrella. These complications are rare, but the sinister effects of thromboembolism must be carefully evaluated on a daily basis, and a high index of suspicion needs to be maintained in this highrisk group of patients.

Hemorrhage

Intraoperative and postoperative pelvic hemorrhages also are discussed in another chapter.

Intraoperative Bleeding

Despite the surgeon's adequate technical skills and careful dissection, serious hemorrhage can suddenly appear, especially during retroperitoneal dissections on the lateral pelvic sidewalls and around the sacrum. When it happens, it is hoped that the operative field will not be cluttered with clamps; exposure, lighting, and suction will be adequate; the patient's condition will be stable; and anesthesia will be sufficient to maintain good relaxation. If the bleeding vessel cannot be clamped quickly, the simplest and most effective method of controlling the bleeding is provided by pressure applied by the index finger of the gloved hand. With cessation of bleeding, the operative site can be cleared of accumulated blood by suctioning, exposure of the area can be improved, and the surgeon can gain a few moments to evaluate the situation and choose the best possible course of action. Arterial bleeding is easy to identify and control with clips, clamps, or ligatures. The difficult problem with hemorrhage in the pelvis comes from lacerations of deep pelvic veins that are fragile, tortuous, distended, sometimes hidden or retracted from view, and sometimes held open by attachment of the vein wall to surrounding tissue. Blood returning through the lacerated vein can come from multiple sources unavailable for ligation. Placing clamps or sutures blindly is dangerous and can even make the problem worse. Sometimes, digital pressure for at least 5 minutes is the most effective procedure to control venous bleeding. Sometimes, additional careful dissection in the area is required to free the vessel above and below the bleeding point to allow more precise clipping or suture ligation. A cardinal rule in dissecting in the pelvis is to avoid creating a deep hole, the bottom of which cannot be exposed in case a deep vein is lacerated. This is the reason that dissection of the pararectal space, for instance, should not be forced if it does not develop easily.

Whenever an extensive pelvic dissection is anticipated, preparations should be made in advance in case severe intraoperative bleeding is suddenly encountered. Adequate quantities of blood should be available to replace lost volume. More blood should be requested in advance of its need, if possible. A responsible member of the operating team or anesthesia team should be assigned the task of monitoring blood loss, blood replacement, and urine output. When bleeding is profuse, in the excitement of the moment, it is possible to lose count of the number of units of whole blood, blood components, crystalloids, and other fluids that have been given and how much blood has been lost. A dependable route for administering blood must be maintained. Without it, rapid blood replacement is not possible. If massive hemorrhage occurs or if even a possibility of its occurrence exists, a Swan-Ganz or similar catheter should be placed for better monitoring of physiologic functions and blood replacement. In extreme cases in which no other vessels are available for rapid intraoperative blood volume replacement, transfusions can be given under pressure directly into the common iliac artery, with the needle pointed in the direction of the heart.

The most frequent site of troublesome intraoperative bleeding during radical hysterectomy occurs from the pelvic floor veins in the dissection of the cardinal ligament and the hypogastric vessels. The collateral venous circulation of the hypogastric veins is an ever-present source of potential hemorrhage owing to difficulty in identification of these vessels as they course among muscle bundles and fascial planes on the pelvic floor. The pararectal fossa, cardinal ligament, and presacral and paraaortic areas are frequent sites of venous bleeding. Therefore, meticulous dissection is important to avoid these complications. When venous bleeding does occur, it can be difficult to identify the site of the lacerated vein. In these circumstances, it is important to use compression of the pelvic floor veins by either a sponge stick or finger held in place for several minutes or to use an abdominal pack placed firmly against the site of bleeding for a similar length of time. In these cases, it is advisable to keep pressure on the vein until full control of the bleeding has been established, in the meantime dissecting in other places in the pelvis. Only when the wall of a major pelvic vein has been severely traumatized and has retracted out of the operative field is there a serious problem in reestablishing hemostasis. In contrast to arterial bleeding, hemorrhage from deep pelvic veins is seldom improved by hypogastric artery ligation, owing to the extensive





collateral venous circulation to the pelvis from the lower extremity and vena cava. It occasionally is beneficial to ligate the anterior division of both hypogastric arteries to determine whether interruption of the major arterial blood supply to the pelvis can reduce the venous bleeding. When more extensive trauma to the wall of the external or common iliac vein has occurred, it is necessary to place vascular clamps above and below the area of injury and to repair the defect with fine vascular sutures.

Postoperative Hemorrhage

This condition is a rare complication of radical pelvic surgery. Because all of the blood supply to the pelvis has been skeletonized as part of the operative procedure, it is exceedingly rare for secondary hemorrhage to occur unless there has been uncontrolled bleeding at the completion of the operation. In these cases, the pelvis usually is packed with multiple gauze packs, with one end exteriorized through the open vagina. Tamponade of the pelvis by means of an umbrella or parachute gauze pack and external ring (see [Chapter 19](#)) has been advocated by some when there is persistent venous oozing in the pelvis at the completion of the operation. Pelvic packs should be advanced within 24 to 48 hours and removed shortly thereafter to avoid ascending infection from the vagina.

In certain cases of postoperative hemorrhage, selective embolization by invasive radiographic techniques can prevent reoperation.

Neuropathies

Nerve injury with radical hysterectomy was reviewed by Hoffman and coworkers, who reported its infrequent occurrence. The most important injuries are to the femoral, obturator, (*Print pagebreak 1246*) peroneal, sciatic, genitofemoral, ilioinguinal, iliohypogastric, lateral femoral cutaneous, and pudendal nerves. Awareness of the anatomic location of these nerves in the operative field, careful surgical technique in dissection and securing hemostasis, careful placement of self-retaining retractors, and careful positioning of patients in stirrups prevent most nerve injuries. Fortunately, most nerve injuries are not associated with serious or permanent disability.

However, injury to the obturator nerve can lead to difficulty with adduction of the lower extremity. Obturator nerve injuries are the most common neurologic injuries, and they occur most frequently during the removal of the obturator lymph nodes from the obturator fossa. If the nerve is transected, it should be repaired as described by Vasilev.

Rectum

Although much less frequently reported than bladder dysfunction, both acute and chronic rectal dysfunction may occur following radical hysterectomy. The rectal dysfunction is characterized by difficulty with defecation and loss of defecation urge and constipation. Barnes and associates reported that postoperative anorectal manometry studies were abnormal in all patients studied, suggesting disruption of the spinal reflex arcs controlling rectal emptying, possibly secondary to partial denervation of the rectum. Nerve-sparing radical surgery will hopefully abbreviate and reduce the burden of this complication. Dietary fiber modifications and rectal stimulation with suppositories over several weeks or months are effective in addressing these problems.

ADJUVANT THERAPY IN CONJUNCTION WITH RADICAL SURGERY

Postoperative Pelvic Irradiation

External beam radiation therapy is used in the postoperative period as an adjunct to radical abdominal hysterectomy and bilateral pelvic lymphadenectomy in selected cases. It is given selectively to patients considered to be at high risk for persistent disease based on operative findings and careful study of the surgical specimens. Previously, if only one or two lymph nodes showed micrometastases, postoperative irradiation may not have been given. However, when several nodes are involved, the risk of persistent disease is greater, and postoperative irradiation is usually given; it can be extended as high as T12 if proximal common iliac or paraaortic nodes are involved with metastatic disease. However, nodal metastasis is not the only risk factor for recurrence, and other local tumor-related factors may be indicators of high-risk tumors that may warrant adjuvant radiation therapy.

Sedlis and associates—in a GOG randomized trial of pelvic radiation therapy versus no further therapy in selected patients with stage IB carcinoma of the cervix with negative lymph nodes after radical hysterectomy and pelvic lymphadenectomy—evaluated the benefits and risk of adjuvant pelvic radiation therapy aimed at reducing recurrence in this group of patients. In this study, 277 eligible patients were entered with at least two of the following tumor-related risk factors: greater than one-third stromal invasion, capillary lymphatic space involvement, or large clinical tumor diameter. [Table 51.13](#) summarizes the eligibility criteria: Of the 277 patients, 137 were randomized to pelvic radiation therapy and 140 to no further treatment. Twenty-one patients (15%) in the radiation therapy group and 39 (28%) in the no-further-treatment group had a cancer recurrence, 18 and 27 of which were vaginal/pelvic, respectively. Life table analysis indicated a statistically significant (47%) reduction in risk of recurrence (relative risk = 0.53, $p = 0.008$, one tail) among the radiation therapy group, with recurrence-free rates at 2 years of 88% versus 79% for the





radiation therapy and no further-treatment groups, respectively. Toxicity was generally acceptable, with severe or life-threatening urologic adverse effects occurring in four (3.1%) in the radiation therapy group and two (1.4%) in the control group. The authors concluded that adjuvant pelvic radiation therapy following radical surgery in selected women with stage IB cervical cancer reduces the number of recurrences at the cost of 6% grade 3 and 4 adverse events versus 2.1% in the control group.

TABLE 51.13 Eligibility Criteria for Radiation Therapy after Radical Hysterectomy in Node-Negative Patients (Sedlis Criteria)

CLVI	STROMAL INVASION	TUMOR SIZE (CM)
+	Deep one third	Any
+	Middle one third	≥ 2
+	Superficial one third	≥ 5
-	Middle or deep one third	≥ 4

From 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 lymph adenectomy: a Gynecologic Oncology Group Study. *Gynecol Oncol* 1999;73:177-183, with permission.

Many physicians use these data to identify node-negative patients with local cervical risk factors following radical hysterectomy and pelvic lymphadenectomy to prescribe adjuvant radiation therapy.

If invasive cervical cancer is unexpectedly found after a simple hysterectomy has been done, postoperative pelvic radiation therapy is recommended. Survival rates in these patients have improved with the advent of megavoltage irradiation, as reported by Andras and coworkers, Davy and coworkers, and Papavasiliou and coworkers. Heller and coworkers reported 35 patients with invasive cervical carcinoma discovered in uteri removed for benign conditions. All patients received postoperative radiation therapy; patients with presumed stage IB disease had a corrected 5-year survival rate of 78%, and those with presumed stage IIB disease had a corrected 5-year survival rate of 67%.

Postoperative Adjuvant Chemoradiation

After radical surgery in high-risk, early-stage cancer of the cervix, Peters and colleagues reported a phase III trial of adjunctive concurrent chemotherapy and pelvic radiation therapy compared with pelvic radiation therapy alone. In all, 243 assessable patients with clinical stage IA (2), IB, and IIA carcinoma of the cervix, initially treated with radical hysterectomy and pelvic lymphadenectomy, and who had positive pelvic lymph nodes and/or positive margins and/or microscopic involvement of the parametrium were evaluated. Patients were randomized to receive platinum-based chemoradiation or radiation only. Patients in each group received 49.3-Gy (*Print pagebreak 1247*) radiation therapy in 29 fractions to a standard pelvic field. Chemotherapy consisted of cisplatin 70 mg/m² and a 96-hour infusion of fluorouracil 1,000 mg/m² day every 3 weeks for four cycles, with the first and second cycles given concurrent to radiation therapy.

Progression-free and overall survivals were significantly better in women receiving chemoradiation. The projected progression-free survival at 4 years was 63% with radiation therapy alone and 80% with chemoradiation. The projected overall survival rate at 4 years was 71% with adjuvant radiation therapy and 81% with adjuvant chemoradiation. However, grade 3 and 4 hematologic and gastrointestinal toxicity were more frequent in the chemoradiation group.

The authors concluded that the addition of concurrent cisplatin-based chemotherapy to radiation significantly improves progression-free and overall survival for high-risk, early-stage patients who undergo radical hysterectomy and pelvic lymphadenectomy for carcinoma of the cervix and are found to have positive pelvic lymph nodes and/or positive margins and/or microscopic involvement of the parametrium. Although the data from this study are compelling, use of this regimen should be undertaken only with understanding of the toxicities encountered.

The data from this randomized trial and the Sedlis trial currently provide practical guidelines for eligibility of patients for adjuvant chemoradiation following primary radical hysterectomy or trachelectomy and pelvic lymphadenectomy.

Postoperative Extended-Field Irradiation or Chemoradiation

In selected cases, with multiple positive pelvic nodes, metastasis to common iliac nodes, or aortic nodal metastasis, patients are treated with pelvic and extended-field radiation to include the paraaortic lymph chain. To numerous previous studies can be added two studies from Japan that describe the results of paraaortic nodal irradiation in the treatment of cervical cancer. Inoue and Morita (1988) administered extended-field radiation after extensive surgery to 76 patients with aortic nodal metastases. Two patients





developed severe intestinal complications that required reoperation. Postoperative extended-field irradiation improved the survival rate of patients with four or more positive nodes from 39% to 69% as well as the survival rate of patients with unresectable nodes from 0% to 44%. The authors concluded that postoperative extended-field irradiation can control the distant spread by way of lymphatic routes and can increase the survival time of patients. In addition, 86 patients with cervical cancer were treated with paraaortic nodal irradiation by Horii and coworkers (1988). None of the patients developed severe complications from the treatment. Based on their selection criteria for paraaortic nodal irradiation, the authors found a statistically significant improvement in the prognosis for the treated group.

In 1987, Jones reported on a collected series of 332 patients with paraaortic lymph node metastases who received extended-field radiation. Twenty-six percent were long-term survivors. Although it is true that most patients with positive paraaortic lymph nodes die of their disease (probably because systemic disease is already present), it also is clear that some patients are curable with extended-field radiation or chemoradiation, especially if the nodes are involved with only microscopic disease. The surgeon must anticipate a 10% incidence of enteric complications even with doses limited to 5,000 cGy. Again, micrometastatic disease is more likely to be eradicated by a dose of paraaortic radiation that can be tolerated by the patient. Patients with paraaortic nodes that contain a large volume of tumor are not likely to be cured, even with a dose of paraaortic radiation that exceeds 5,000 cGy, unless the bulky nodes are excised before the irradiation.

Extended-field chemoradiation also may be used. The GOG reported on a multicenter trial of chemoradiation therapy to evaluate the feasibility of extended-field radiation therapy with 5-fluorouracil (5-FU) and cisplatin and to determine the progression-free interval, overall survival, and recurrence sites in patients with biopsy-confirmed paraaortic node metastases from cervical carcinoma. In all, 86 evaluable stage I to IV patients with aortic metastases were reported. Radiation therapy doses were 4,500 cGy to paraaortic nodes, and concomitant chemotherapy consisted of 5-FU 1,000 mg/m² per day for 96 hours and cisplatin 50 mg/m² in weeks 1 and 5.

Initial sites of recurrence were pelvis alone, 20.9%; distant metastases only, 31.4%; and pelvic plus distant metastases, 10.5%. The 3-year overall and progression-free survival rates were 39% and 34%, respectively, for the entire group. Overall survival was stage I, 50%; stage II, 39%; and stage III/IVA, 38%.

GOG grade 3 and 4 acute toxicity was gastrointestinal (18.6%) and hematologic (15.1%). Late morbidity actuarial risk of 14% at 4 years primarily involved the rectum. The authors concluded that extended-field radiation therapy with 5-FU and cisplatin chemotherapy was feasible in a multicenter clinical trial, that a progression-free survival of 33% at 3 years suggests that a proportion of patients achieve control of advanced pelvic disease, and that not all patients with paraaortic metastases have systemic disease. This points to the importance of assessment and treatment of paraaortic metastases.

Adjuvant Postoperative Chemotherapy

Few studies of adjuvant chemotherapy following radical hysterectomy have been done. Wertheim et al. from Memorial Sloan Kettering Cancer Center in 1985 reported on a pilot study of adjuvant chemotherapy with cisplatin and bleomycin and pelvic radiation therapy in patients with cervical cancer at high risk of recurrence after radical hysterectomy and pelvic lymphadenectomy.

The continuous disease-free survival rate for the 32 evaluable patients was 84% at a median follow-up time of 28 months. In addition, the complications of this treatment program were not significantly greater than those observed in prior studies using the combination of surgery and adjuvant radiation therapy without chemotherapy. When compared with the results from historical controls in a large series of similar patients at the same institution, the results in this pilot study were encouraging and appeared to justify a randomized prospective clinical trial.

Two randomized trials have attempted to clarify the role of adjuvant postoperative chemotherapy. In 1992, Tattersall and colleagues reported a randomized trial comparing standard pelvic radiation therapy versus three cycles of combination chemotherapy with cisplatin, vinblastine, and bleomycin followed by pelvic radiation therapy. No difference in disease-free or overall survival emerged between the two treatment groups. Relapse was more common in patients with nonsquamous tumors (44%) and in those with metastases in several pelvic lymph nodes.

In 1996, Curtin et al. from MSKCC reported on a prospective multicenter randomized phase III trial of adjuvant chemotherapy versus chemotherapy plus pelvic irradiation for (*Print pagebreak 1248*) high-risk stage IB to IIA cervical cancer patients after radical hysterectomy and pelvic lymphadenectomy. The objective was to compare the clinical efficacy of adjuvant chemotherapy alone versus chemotherapy plus whole pelvic radiation therapy on recurrence rates, patterns of recurrence, and survival of patients after radical hysterectomy and pelvic lymphadenectomy for cervical cancer at high risk for recurrence.

Risk factors included deep cervical invasion, tumor greater than 4 cm, parametrial involvement, nonsquamous histology, and/or pelvic lymph node metastasis. Chemotherapy consisted of cisplatin and bleomycin alone or in combination with whole pelvic radiation therapy. Eighty-nine patients were entered, 19 had recurrences, and 16 died. Nine of 44 (20%) patients receiving





chemotherapy alone recurred compared with 10 of 45 (22%) patients receiving chemotherapy and radiation ($p = \text{NS}$). Patterns of recurrence were statistically similar between the two treatment arms, even among the subgroup of patients with more than three risk factors. In addition, both regimens were well tolerated. The authors concluded that recurrence rates and patterns of recurrences (local, regional, or distant) were not influenced by the addition of radiation therapy.

However, in view of the more recent randomized trial of adjuvant chemoradiation, most high-risk patients with nodal metastasis will probably be offered adjuvant platinum-based chemoradiation. Whether weekly cisplatin or other platinum-based regimens are the optimal choice remains to be determined.

FOLLOW-UP AFTER RADICAL SURGERY FOR CERVICAL CANCER

Despite carefully planned and executed radical surgery for early-stage cervical cancer, 5% to 20% of patients in various series show evidence of recurrent or persistent tumor. About half occur in the first year after treatment. Almost all occur within the first 3 years. Few occur later. Recurrences many years later are extremely rare after primary surgical treatment and are more likely to be seen in patients treated with primary radiation therapy.

Persistent or recurrent disease after primary radical surgery may represent incomplete resection of the central tumor undetected at operation or by the pathologist's examination of the surgical specimen. Microscopic metastatic involvement of lymph nodes may be undetected by incomplete pathologic examination, or these nodes may be left behind by incomplete lymphadenectomy. Viable tumor cells in small numbers may escape by way of lymphatics or vascular channels to distant sites and overcome host resistance. Probably in as many as 10% of patients with persistent disease, recurrence may result from continued growth of unrecognized intraperitoneal spread of tumor.

After the immediate postoperative recovery is completed, patients are scheduled for regular follow-up examinations, which vary depending on circumstances. Patients who are at greater risk for recurrence should be followed especially closely at frequent intervals. These usually are the same patients who have been given postoperative therapy, including patients with metastatic disease in lymph nodes and/or parametria, close surgical margins, large-volume cervical tumors, deep cervical stromal invasion, and lymphatic and/or vascular channel involvement. The frequency of examination varies somewhat from patient to patient. Most patients are seen every 3 to 6 months during the first 3 years after primary treatment, every 6 months during the 4th and 5th years, and annually thereafter. Patients are instructed to immediately report unusual signs or symptoms (e.g., vaginal bleeding or discharge, leg swelling or discomfort, discomfort in the pelvis, difficulty with urination or defecation, enlarged neck or groin nodes). Krebs and coworkers, however, reported that 25% of their patients did not have symptoms when persistent disease was diagnosed. In the study reported by Larson and coworkers, 37% did not have symptoms.

A follow-up examination should include palpation of the neck for enlarged lymph nodes, abdominal and leg examination, and a speculum and bimanual rectovaginal pelvic examination. A vaginal cytology smear is performed with each visit. Computed tomography or MRI scan of the abdomen and pelvis, PET scan, proctosigmoidoscopy, cystoscopy, and biopsy (needle, punch, or both) of any suspicious lesions may be required, depending on the patient's symptoms and examination findings. These special diagnostic procedures are not done routinely as part of postoperative follow-up surveillance in patients without symptoms. Positive findings are rare, unless the patient has symptoms. For example, IVP seldom shows ureteral obstruction in a patient who does not also have symptoms of persistent pelvic sidewall disease and is, therefore, not routinely done at specific intervals. It is in the patient's best interest to have follow-up examinations done in the same center in which her treatment was administered. Findings at each visit must be compared with previous information all the way back to her original presentation.

Soisson and coworkers reported a comparison of symptoms, physical examination, and vaginal cytology in the detection of recurrent cervical carcinoma after radical hysterectomy. The study group consisted of 203 women with stage IB and IIA cervical cancer followed at the Duke University Medical Center. Thirty-one (15%) patients developed recurrence. For the detection of recurrent tumor, vaginal cytology had a sensitivity and specificity of 13% and 100%, pelvic or general physical examination 58% and 96%, and the presence of suspicious symptoms 71% and 95%, respectively. Ninety-four percent of all patients with recurrent tumor had at least one abnormal surveillance index. Another Duke study by Weber and associates found that MRI correctly demonstrated the extent of recurrence in 18 of 21 cases.

Regular pelvic examinations and vaginal cytology smears may detect a central pelvic recurrence early. This can be a great advantage. Just as it is important to detect the original cancer in the earliest stage possible so that the patient can have the best possible chance of cure, it also is important to detect persistent disease at the earliest possible moment for the same reason. For example, Jobsen and coworkers reported on the use of radiation therapy to treat local-regional recurrence of carcinoma of the cervix after primary surgery. The overall 5-year survival rate was 44%. Response to radiation therapy was strongly correlated with tumor volume, providing additional supportive evidence to the idea that persistent disease should be diagnosed as early as possible and, it is hoped, when the volume of persistent tumor is still small and responsive.





Patients with recurrent or persistent cancer of the uterine cervix after initial radiation therapy can have radical surgery provided the disease is limited and judged to be surgically resectable. Usually, some type of pelvic exenteration is required to resect the recurrent tumor with negative margins. In carefully selected patients with centrally recurrent disease, 5-year survivals of 40% to 60% have been reported. Pelvic exenteration is discussed in another chapter.

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Tumor ulceration in the upper vagina can produce vaginal discharge and spotting, a palpable tumor mass, and induration and nodularity of tissue extending to the pelvic sidewalls. Pain may not be present unless the tumor involves nerve roots. Symptoms related to urination and defecation can result from pressure, infection, or tumor involvement of the bladder and rectum. Either unilateral or bilateral edema of the lower extremities or unilateral or bilateral hydronephrosis can be an ominous sign of persistent disease, but these also can be the result of a combination of the effects of radical surgery and postoperative irradiation. When initially diagnosed, recurrences are central in about one fourth of patients, involve the pelvic sidewall in one fourth, and involve distant sites in one fourth; the remaining one fourth of patients have multiple sites of involvement.

Approximately 20% to 25% of patients with recurrence after primary radical surgery still can be cured. The best chance of cure is in patients who had no postoperative radiation treatment and no metastatic disease to pelvic lymph nodes and in whom persistent disease is limited to the central pelvis. A combination of total pelvic irradiation plus vaginal brachytherapy can be effective in controlling the disease. The addition of concurrent platinum-based chemotherapy also should be considered.

Chemotherapy can be given for palliation when there is evidence of unresectable persistent disease in the pelvis in patients who have already received postoperative pelvic radiation or when there is metastatic disease in distant sites.

Because recurrence or persistence of cervical cancer after treatment is difficult but important to detect as early as possible, attempts have been made to use a serum marker that would monitor the course of the disease. Kato and Torigoe isolated a squamous cell carcinoma antigen from cervical carcinoma tissue. A squamous cell carcinoma antigen radioimmunoassay kit developed by Abbott Laboratories (Abbott Park, IL) has been tested, but the role of this antigen in the follow-up of patients with cervical carcinoma is yet to be determined.

Although the early detection of persistence is the primary purpose of and justification for follow-up visits, assessment of urinary tract function also is important. Particular attention should be paid to bladder function and maintaining a satisfactory voiding pattern. Urinary tract infection should be diagnosed and treated promptly. If ureteral stenosis impairs renal function, early intervention can be successful in avoiding nephrectomy. This is more likely to be seen in patients who receive a combination of radical surgery and irradiation as primary treatment.

Rehabilitation of sexual function after surgical therapy for cervical cancer usually is easily done by the patient and her partner but is more difficult if the vagina and paravaginal tissues have received heavy doses of radiation or if the patient has lost ovarian function as a result of treatment. The gynecologic surgeon should inquire about sexual problems and should give advice and permission when needed. Counseling, including instruction in the technique of alternative means of sexual gratification, may be needed. If ovarian function has been lost as a result of treatment, estrogen replacement therapy should be provided, even though symptoms of hypoestrogenism are not present. If normal ovaries were conserved, their function should be monitored with periodic follicle-stimulating hormone and estrogen levels so that estrogen replacement can be discussed when ovaries cease functioning in future years. There may be other contraindications to estrogen replacement therapy in patients treated for cervical cancer, but a history of treatment for cervical cancer is not one of them.

And finally, patients who have been treated for cervical cancer are at greater risk for developing other primary cancers at different sites, especially if their treatment included irradiation. Detection of other primary cancers should be part of posttreatment follow-up. This subject has been studied by Hoffman and coworkers, Buchler, and others. Axelrod and coworkers reported that 3.9% of patients with invasive cervical cancer had second primaries. In 1987, Arneson and Kao reported that 61 new primary cancers were detected among 718 patients with invasive cervical cancer who had been studied from 1955 to 1979.

RADIATION THERAPY

Although radical hysterectomy is generally recommended for women with early-stage cervical cancer who can tolerate the surgery, women with stage IIB or more advanced disease are usually treated with radiation therapy. Radiation is also appropriate for women who are poor surgical candidates because of medical conditions or age.

Ionizing radiation can destroy tumor and cure cancer effectively. Radiation therapy for cervical cancer is usually delivered by two techniques. *Intracavitary therapy* or *brachytherapy* is administered by placing a radioactive element—such as radium, cesium, or iridium—in close contact with the tumor. This produces a very effective, high-dose local treatment, but the dose rate delivered falls





off very sharply as the distance away from the radioactive source increases. This is called “the inverse square law.” The radiation dose delivered to a given point is equal to 1 divided by the square of the distance away from the radiation source ($\text{dose} = 1/\text{distance}^2$). Because of the rapid decrease in the dose, it is necessary to treat potential pelvic lymph node metastases and large primary cervical cancer with *external beam radiation*. This type of radiation was originally produced by modified diagnostic x-ray machines, but now, special high-energy linear accelerators or betatrons are used. These machines are capable of delivering a uniform dose of radiation across the whole pelvis or even an extended field to include the paraaortic lymph nodes.

The use of radiation for the treatment of cervical cancer followed very shortly after the discovery of radium by Marie and Pierre Curie. Beginning in 1903, several methods of intracavitary therapy were developed, including the Stockholm technique from the Radiumhemmet; the Paris technique, designed at the Curie Foundation; and the Manchester technique from England. The Stockholm radium technique consisted of high-intensity central irradiation, repeated two or three times within 3 weeks, whereas the Paris technique used low-intensity central irradiation, continuously delivered over 1 week. The Manchester technique, derived from the Paris method, used low-dosage rates that required at least two separate intracervical insertions of radiation sources. Other radioactive elements, including cesium and iridium, have replaced radium in central brachytherapy for cervical cancer.

The traditional brachytherapy systems for cervical cancer have been low-dose-rate systems delivering 0.4 to 2 Gy per hour, and typical implants have been of 24- to 72-hour durations. More recently, high-dose-rate systems have been employed capable of delivering dose rates of more than 0.2 Gy per minute, thereby allowing treatments of only a few minutes' duration and adaptable to the outpatient—rather than the inpatient—setting. A comparison of 5-year survival rates of the two systems by clinical stage documents the usefulness of the newer system ([Table 51.14](#)).

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TABLE 51.14 5-Year Survival Rates of Patients with Stage I Cancer of the Cervix by Treatment Modality

INVESTIGATORS	NUMBER OF PATIENTS	5-YEAR SURVIVAL RATE (%)
SURGERY		
Morley and Seski (1976)	149	91.3
Zander et al. (1981)	747	84.5
Noguchi (1987)	191	85.3
Barber (1988)	273	78.8
Carenza (1988)	105	85.7
Fuller et al. (1989)	285	86.0
Kentler (1989)	178	87.0
Lee (1989)	237	86.1
Monaghan (1990)	494	83.0
Hopkins (1991)	213	89.0
Alvarez (1991)	401	85.0
Burghardt (1992)	443	83.4
Massi (1993)	211	75.8
Total	3,526	84.2
RADIOTHERAPY		
Madowski et al. (1962)	442	81.3
Kottmeier (1964)	611	89.5
Crawford et al. (1965)	63	46.0
Masubuchi et al. (1969)	152	88.2
Marcial (1970)	41	87.0
Neinminen and Pollanen (1970)	77	70.0
Fletcher (1971)	549	91.5
Newton (1975)	61	74.0
Einhorn (1975)	60	88.0
Petersson (1987)	160	76.9
Total	2,196	85.1

With the establishment of the roentgen as a defined unit of radiation exposure (Stockholm, 1921), it became possible to measure the





quantity of irradiation delivered to the tumor. Although many clinicians are most familiar with the dosing measure of rads, modern therapy is calculated in grays (Gy) [1 Gy = 100 rads; 1 centigray (1 cGy) = 1 rad]. Highenergy, external beam radiation sources, ranging to 25 mV for the betatron and linear accelerator, have significantly reduced the complication rates after radiation therapy and have improved the cure rates. An intracavitary pelvic dosage derived from the gamma rays of radium or cesium is complementary to the megavoltage external beam irradiation to ensure tumoricidal dosages to the cervix, broad ligaments, and lateral pelvic walls. Extended fields of external radiation can deliver therapy to common iliac and aortic nodal tissues.

The balance between enough radiation to destroy the tumor and too much radiation (which results in damage to adjacent normal tissues such as the bladder, vagina, or rectum) is sometimes difficult to achieve. It requires using the correct combination of brachytherapy with external radiation therapy. Treatment planning has been enormously improved in recent years because of the integration of imaging techniques (such as CT scanners) with computer programs that can calculate the dose to the tumor volume and adjacent normal tissues, which helps the radiation oncologist maximize the tumor dose while minimizing the damage to nearby organs.

TABLE 51.15 Comparison of Outcomes with High Dose Rate (HDR) versus Low-Dose Rate (LDR) Brachytherapy for Cervical Cancer (5-Year Actuarial Survival Rates)

ENDPOINT	STAGE	LDR GROUP	HDR GROUP	p-VALUE
Overall survival	I	83%	80%	0.77
	II	78%	71%	0.30
	III	46%	36%	0.04
Disease-free survival	I	83%	82%	0.80
	II	82%	71%	0.12
	III	49%	37%	0.03
Local control	I	92%	91%	0.92
	II	87%	75%	0.09
	III	58%	50%	0.19

Reprinted from Ferrigno R, Nishimoto IN, Novaes PE, et al. Comparison of low and high dose rate brachytherapy in the treatment of uterine cervix cancer. Retrospective analysis of two sequential series. *Int J Radiat Oncol Biol Phys* 2005;62(4): 1108-1116, with permission. Copyright © 2005 Elsevier Inc. All rights reserved.

Survival rates of irradiation and primary surgery can be compared by analyzing the reports from patients treated for stage I cervical cancer. Patients treated by irradiation have an average 5-year survival rate essentially identical to the survival rate for those who undergo radical surgery ([Table 51.15](#)).

In the United States, radical hysterectomy generally is recommended for women with stage IA2 and IB1 cervical cancer who are good operative risks, especially if they are premenopausal. Women with larger tumors and those who are at risk for surgical complications generally are referred for radiation therapy.

SUMMARY

Many improvements have been made in the operative technique of the radical hysterectomy and lymphadenectomy since its original description. The incidence of complications after this procedure has decreased during the past 75 years, and the survival rates have increased. The operation has achieved its peak of clinical usefulness during this period and is now considered the principal method of treatment of early invasive carcinoma of the cervix. Among the better surgical institutions, the meticulous execution of this operative procedure has reduced the incidence of complications to an acceptable and infrequent occurrence. In medical centers in which the operation is performed well, the 5-year cure rate for stage IB1 carcinoma of the cervix is greater than 90%. Newer laparoscopic approaches are gaining acceptance, with comparable cure rates and the potential to retain fertility in carefully selected patients. Radical trachelectomy has proven safe and effective for selected patients with stage I tumors who wish to preserve their fertility.

Comparative studies with primary radiation therapy have demonstrated an equal cure rate with primary radical surgery in the treatment of early-stage disease. However, the complications of irradiation are more difficult to manage than are those of primary surgery. In young women, when preservation of (*Print pagebreak 1251*) ovarian function is important, primary surgery is a preferable choice of treatment.





The major limiting factor in the long-term surgical cure of cervical cancer is related to the spread of the disease at the time of initiation of treatment. Historically, in cases in which pelvic lymph nodes were positive for metastatic tumor, the 5-year cure rate was reduced to approximately 60%. However, numerous recently reported prospective, randomized trials have demonstrated the benefit of concurrent chemotherapy and radiation therapy in various settings. In the management of high-risk patients after radical hysterectomy and pelvic lymphadenectomy, including those with positive nodes, the reported 4-year disease-free survival is 80%.

It is important to understand that it is the individual surgical expertise that offers the highest cure rate and lowest incidence of complications to the patient with invasive carcinoma of the cervix. One of the greatest errors in clinical judgment is made by the gynecologist who attempts a radical hysterectomy and pelvic lymph node dissection without adequate surgical training and experience. Unless the pelvic surgeon is performing this type of surgery regularly in a well-staffed medical center with trained assistants, he or she would be well advised to refer the patient to an established cancer center. From the patient's point of view, the initial treatment, whether primary surgery or irradiation, provides the best chance for long-term cure of this disease. It would be to her advantage to have the treatment conducted in the most expert hands because secondary treatment for recurrent disease offers only limited potential long-term cure.

BEST SURGICAL PRACTICES

- Invasive cancer of the cervix is predominantly of squamous histology. Adenocarcinoma is increasingly common in many practices and now accounts for up to 20% to 50% of the lesions in some series. Adenosquamous, clear cell, and small cell neuroendocrine histology are seen infrequently. Tumor grade in squamous lesions is not prognostically significant, but grade may be important in adenocarcinoma lesions.
- Although most women with early-stage cancer are asymptomatic, patients with larger tumors may have vaginal discharge, vaginal bleeding (especially postcoital bleeding), and eventually pelvic or low back or hip pain. Leg edema and ureteral obstruction are signs of advanced disease.
- A careful and thorough staging workup should be done after a diagnosis is made. This evaluation of the extent of disease is very important for treatment planning and prognosis. FIGO staging should be used, but the metastatic workup should not be limited by FIGO's restrictive guidelines. MRI and PET scans provide very important information to guide treatment even though they are not part of the FIGO staging system.
- Patients with microinvasion (stage IA1) are generally treated with cone biopsy or simple hysterectomy. Patients with stage IA2 disease should be treated by radical hysterectomy or trachelectomy with pelvic lymphadenectomy. Most of these patients can be adequately treated by a modified radical hysterectomy (type B), but women with larger tumors and LVSI may benefit from a traditional (type C1) radical hysterectomy. Expert gynecologic pathology review is essential for correct diagnosis.
- In the United States, most women with stage IB1 and stage IIA cervical cancer are treated with radical surgery. Women with larger, higher-stage tumors are usually treated with radiation therapy plus adjuvant chemotherapy. Women who are poor surgical risks are also usually treated with radiation $\pm$ chemotherapy. The main advantage of surgery compared with radiation is the preservation of ovarian function, which is most advantageous in younger patients. There is also less risk of upper vaginal stenosis and dyspareunia following surgery. Bladder and rectal dysfunction and, rarely, fistulae occur with both surgery and radiation. Surgical complications tend to occur in the perioperative period, whereas complications and side effects from radiation are often delayed and long lasting.
- Radical surgery for cervical cancer requires training, experience, and good ancillary support. This means well-trained operating room personnel; surgical assistants, and anesthesia staff, as well as adequate radiology, intensive care, and consulting physicians need to be a regular part of the patient care team.
- In a radical hysterectomy for stage IB cervical cancer, we do not routinely do a paraaortic lymphadenectomy, but any suspicious nodes are removed and sent for frozen section. The surgical procedure is usually abandoned if aortic lymph node metastases are identified.
- Radical hysterectomy for cervical cancer can be done using the classic abdominal approach, a vaginal approach (Schauta), or a total laparoscopic or robotic approach. There are advantages and disadvantages to each of these techniques, but overall survival appears to be similar. The basic technique is the same.

Fertility-sparing radical trachelectomy with lymphadenectomy has become a standard of care in many practices. Women with stage IA and early IB1 tumors who wish to preserve fertility have been treated successfully, and the cure rates are comparable





to radical hysterectomy. SLN mapping techniques for operable stage I cervical cancer are gaining popularity worldwide and have become a standard of care in many practices.

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