Comprehensive Manuals of Surgical Specialties

Richard H. Egdahl, editor

Byron J. Masterson

Manual of Gynecologic Surgery

Second Edition

With Contributions by Charles V. Capen, James W. Daly
J. Andrew Fantl, Jamil A. Fayez, Ernest W. Franklin, III
Katrine Kirn, Kermit E. Krantz, Javier F. Magrina
Larry L. McMullen, Walter M. Wolfe, Marvin A. Yussman

Illustrated by Deanne McKeown

Includes 294 Illustrations, Mostly in Full Color

Springer-Verlag
New York Berlin Heidelberg Tokyo

SERIES EDITOR

Richard H. Egdahl, M.D., Ph.D., Professor of Surgery, Boston University Medical Center, Boston, Massachusetts 02118, USA

AUTHOR

Byron J. Masterson, M.D., Professor and Chairman, Department of Obstetrics and Gynecology, University of Louisville, Louisville, Kentucky 40292, USA

MEDICAL ILLUSTRATOR

Deanne McKeown, Uppercase Graphics, Box 1388, Sedona, Arizona 86336, USA

Library of Congress Cataloging in Publication Data
Masterson, Byron J.
Manual of gynecologic surgery.
(Comprehensive manuals of surgical specialties)
Bibliography: p.
Includes index.
1. Gynecology, Operative. I. Capen, Charles V.
II. Title. III. Series. [DNLM: 1. Genitalia, Female—surgery. WP 660 M421m]
RG104.M34 1986 618.1'45 85–27884

Softcover reprint of the hardcover 1st edition 1979

Typeset by Kingsport Press, Kingsport, Tennessee.

9 8 7 6 5 4 3 2 1

ISBN-13: 978-1-4612-9334-7 e-ISBN-13: 978-1-4612-4860-6
DOI:10.1007/978-1-4612-4860-6

This book is dedicated to my family

Editor's Note

Comprehensive Manuals of Surgical Specialties is a series of surgical manuals designed to present current operative techniques and to explore various aspects of diagnosis and treatment. The series features a unique format with emphasis on large, detailed, full-color illustrations, schematic charts, and photographs to demonstrate integral steps in surgical procedures.

Each manual focuses on a specific region or topic and describes surgical anatomy, physiology, pathology, diagnosis, and operative treatment. Operative techniques and stratagems for dealing with surgically correctable disorders are described in detail. Illustrations are primarily depicted from the surgeon's viewpoint to enhance clarity and comprehension.

Other volumes in the series:

Published:

Manual of Burns
Manual of Surgery of the Gallbladder, Bile Ducts, and Exocrine Pancreas
Manual of Gynecologic Surgery
Manual of Urologic Surgery
Manual of Lower Gastrointestinal Surgery
Manual of Vascular Surgery, Volume I
Manual of Cardiac Surgery, Volume I
Manual of Cardiac Surgery, Volume II
Manual of Liver Surgery
Manual of Ambulatory Surgery
Manual of Pulmonary Surgery
Manual of Soft-Tissue Tumor Surgery
Manual of Endocrine Surgery (Second Edition)
Manual of Vascular Access, Organ Donation, and Transplantation
Manual of Aesthetic Surgery
Manual of Upper Gastrointestinal Surgery

In Preparation:

Manual of Vascular Surgery, Volume II
Manual of Orthopedic Surgery

Manual of Trauma Surgery
Manual of Reconstructive Surgery
Manual of Sports Surgery

Richard H. Egdahl

Preface to the Second Edition

The *Manual of Gynecologic Surgery* is a comprehensive guide for operative decision-making and technique in female pelvic surgery. For a wide array of problems requiring surgical intervention this volume examines the anatomy, preoperative evaluation, surgical strategy, details of technique, postoperative management, and anticipated results. The management of operative complications and injuries to bowel, urinary system and pelvic vessels is discussed. The psychosocial and legal aspects of gynecologic surgery are also included.

This volume is divided into three sections: ambulatory, vaginal, and abdominal surgery. The ambulatory section will be particularly useful to the family physician. The abdominal section explains complication management for the gynecologist whose surgical background may not include gastrointestinal or urinary tract surgery. The section on ovarian surgery contains additional data for the general surgeon who may encounter unexpected ovarian lesions. Although the book should be most useful to gynecologic residents-in-training and practicing gynecologists, it will also be of use to general surgeons who perform gynecologic operations and to all physicians who perform ambulatory gynecologic procedures.

The operative techniques depicted are currently used procedures based on the newer concepts of wound healing and suturing, utilizing modern surgical instrumentation. When several techniques are available the author's personal preference is described.

This edition was produced by the project manager system and represents the efforts of numerous people in five different cities. Margaret M. Steptoe managed the project with drive, understanding and skill. She was responsible for coordinating information retrieval, organizing the chapters, editing the text, communications with the publisher, illustrator and authors, and a myriad of details.

As in the first edition, Deanne McKeown illustrated the entire book. The preliminary sketches were prepared from notes and sketches made in the operating room during actual performance of the techniques described. After thorough graphic and anatomic research, they were reviewed by the author, then skillfully rendered in color. The final transparent watercolor plates visually communicate the essence of the surgical procedures and are testimony to the artist's outstanding abilities.

Dr. I. Keith Stone reviewed the medical literature and was responsible

for a significant portion of the new information in this book. His ability to select the important developments from the literature of the last five years was essential to the completion of this second edition. Further, Dr. Stone's original research on wounds and sutures is included in this volume.

Dr. Felix Rutledge and Dr. Laman Gray, Sr., in addition to all the named authors, made valuable comments. Their years of experience were especially helpful in updating the chapters on ovarian surgery and vaginal hysterectomy.

My personal Administrative Assistant, Elizabeth Davies, successfully coordinated my various clinical schedules, speaking engagements and department obligations, providing me the time necessary for writing this book.

The advice and support of Jerry Stone, Senior Medical Editor, Springer-Verlag, also were invaluable in the production of this edition.

Lastly, one of our team became ill while we were preparing this book and subsequently died of a rare malignancy. Her outstanding work while with us and her continued interest and encouragement, even though quite ill, was an inspiration to all of us. Mrs. Sue Koenig was a bright, competent and effective co-worker whom is missed by all of us in the Department of Obstetrics and Gynecology at the University of Louisville.

Byron J. Masterson

Preface to the First Edition

The *Manual of Gynecologic Surgery* is a comprehensive guide for operative decision-making and technique in female pelvic surgery. For a wide array of problems requiring surgical intervention, this volume examines the anatomy, preoperative evaluation, surgical strategy, details of technique, postoperative management, and anticipated results. The management of operative complications and injuries to bowel, urinary system, and pelvic vessels is discussed.

This volume is divided into three sections: ambulatory, vaginal, and abdominal surgery. The ambulatory section will be particularly useful to the family physician. The abdominal section explains complication management for the gynecologist whose surgical background may not include gastrointestinal or urinary tract surgery. The section on ovarian surgery contains additional data for the general surgeon who may encounter unexpected ovarian lesions. Although the book should be most useful to gynecologic residents-in-training and practicing gynecologists, it will also be of use to general surgeons who perform gynecologic operations and to all physicians who perform ambulatory gynecologic procedures.

The operative techniques depicted are currently used procedures based on the newer concepts of wound healing and suturing, utilizing modern surgical instrumentation. When several techniques are available, the author's personal preference is described.

This book, which was produced by the project manager system, represents the efforts of 21 persons in three cities. Christine G. Williamson managed the project with drive, understanding, and skill. She was responsible also for coordinating information retrieval, organizing the chapters, and editing the text.

To maintain artistic uniformity, Deanne McKeown illustrated the entire book. The preliminary sketches were prepared from notes and sketches made in the operating room during actual performance of the techniques described. After thorough graphic and anatomic research, they were reviewed by the author, then skillfully rendered in color. The final transparent watercolor plates present visual communication of the essence of the surgical procedures included here.

A full-time research staff comprised of Dr. William Hamilton, Scott Smith, and David Wright, reference librarian, abstracted references from the medical literature for the last 10 years on each topic. This large amount of data was narrowed to as few references as possible, consistent with the intent of each chapter. These efforts contributed to the constant reviewing and updating of the text during its 15 months of preparation.

My three fellows, Drs. Tom Snyder, Tom Sullivan, and Javier Magrina, were helpful in correlating, reviewing, and retrieving valuable information. In addition, their contribution to the improved level of surgical care on the gynecologic surgical service is appreciated.

My Section Manager, Felicia Weiner, successfully coordinated my various clinic and operating room schedules, speaking engagements, and university and other obligations to provide me the time necessary for the writing of this book. The advice and encouragement of A. J. Yarmat, Ph.D., Director of Communications for the University of Kansas, also contributed to the development of this book.

Byron J. Masterson

Contents

10 Anterior Colporrhaphy 135

11 Vaginal Prolapse 140

12 Rectovaginal Fistula and Anal Incontinence 149

13 Vesicovaginal Fistula 157

Kermit E. Krantz

14 Surgery of the Vulva

Ernest W. Franklin, III

III Abdominal Surgery

Contributors

Charles V. Capen, M.D., Scott & White Clinic, Temple, Texas
James W. Daly, M.D., Professor and Chairman, Department of Obstetrics and Gynecology, Creighton University, Omaha, Nebraska
J. Andrew Fantl, M.D., Assistant Professor, Department of Obstetrics and Gynecology, Medical College of Virginia, Richmond, Virginia
Jamil A. Fayez, M.D., Professor, Department of Obstetrics and Gynecology, Bowman Gray School of Medicine, Winston-Salem, North Carolina
Ernest W. Franklin, III, M.D., Gynecologic Oncology, PC, 5669 Peachtree Dunwoody Road, NE, Atlanta, Georgia
Katrine Kirn, Ph.D., OB-GYN Associates, 601 South Floyd Street, Louisville, Kentucky
Kermit E. Krantz, M.D., Professor and Chairman, Department of Gynecology and Obstetrics, Kansas University Medical Center, Kansas City, Kansas
Javier F. Magrina, M.D., Associate Professor, Department of Obstetrics and Gynecology, University of Missouri at Kansas City, Truman Medical Center, Kansas City, Missouri
Larry L. McMullen, LL.B., Blackwell Sanders Matheny Weary & Lombardi, Five Crown Center, Kansas City, Missouri
Walter M. Wolfe, M.D., Associate Professor, Department of Obstetrics and Gynecology, University of Louisville, Louisville, Kentucky
Marvin A. Yussman, M.D., Professor, Department of Obstetrics and Gynecology, University of Louisville, Louisville, Kentucky

Ambulatory Surgery

I

Ambulatory Surgery 1

Ambulatory surgical procedures are no different from inpatient surgical procedures and are accompanied by the same preoperative visit, explanation of the procedure, appropriate operative permission forms, a brief note concerning the procedure, and postoperative instructions.

It is important to establish standard protocols for each procedure performed on an ambulatory surgical service. For example, prepare preoperative setup instructions accompanied by instrument lists and glossy photographs of properly arranged instruments. Keep these instructions in the surgical area so that the instruments will be available to the surgeon in a complete and consistent fashion. As most of the procedures described herein are performed on patients who are awake and alert, it is important there be no confusion or inappropriate delays. The surgical area should be relatively quiet and talking among surgical staff limited to professional matters.

Patients should be treated in a sympathetic and understanding manner with repeated assurances given. Often the patient has no standard for comparison and must be reassured that the procedure is progressing satisfactorily.

During the office visit preceding the surgical procedure, the patient should be advised to have someone accompany her home if the procedure involves sedation or possible significant blood loss. In addition, the patient is given a printed instruction sheet that contains the "do's and don'ts" following such surgical procedure and a description of anticipated side effects, such as the amount of bleeding to be noted. Phone numbers where the physician may be reached after office hours, a prescription for pain medication, and a return appointment are provided when the patient is sent home following the procedure.

Investigation of the most common gynecologic symptoms of pelvic pain or of abnormal vaginal bleeding and the performance of various surgical procedures, including sterilizations, are well managed in the ambulatory patient. Specific techniques are considered in the sections to follow.

Vulvar Ambulatory Surgery

The biopsy is the hallmark of the successful management of vulvar lesions and is satisfactorily accomplished in the ambulatory patient. Although cancer of the vulva is rare and represents approximately 4% of carcinoma found in the gynecologic patient, early detection by biopsy of the vulvar lesion is mandatory.[18] Vulvar cure rates closely approximate the stage of disease when first seen, and early diagnosis is only possible with biopsy of a suspicious vulvar lesion. Biopsies vary from a small punch biopsy obtained with a disposable 3-mm punch to elliptical biopsies as performed with small sharp scissors and thumb forceps. Large lesions such as psoriasis or areas of hypertrophic disease are studied with a punch biopsy; the smaller lesions such as solid modules, nevi, and small discrete neoplastic processes are best totally excised and submitted for pathologic examination.

Punch Biopsy of Vulvar Lesions

Dermatologic punch biopsies are quite satisfactorily performed in the ambulatory patient (Figs. 1-1 and 1-2). Instruct the patient to cut the hair with scissors in the area of the lesion before the surgery; no shaving is required. Colored preparation solutions are not recommended as they prevent a clear definition of the area for biopsy purposes. Toluidine blue staining of the vulva is occasionally useful to outline such areas of abnormal cellular activity and may be used when definite lesions are difficult to outline. Remember, toluidine blue does not stain Paget's disease effectively.

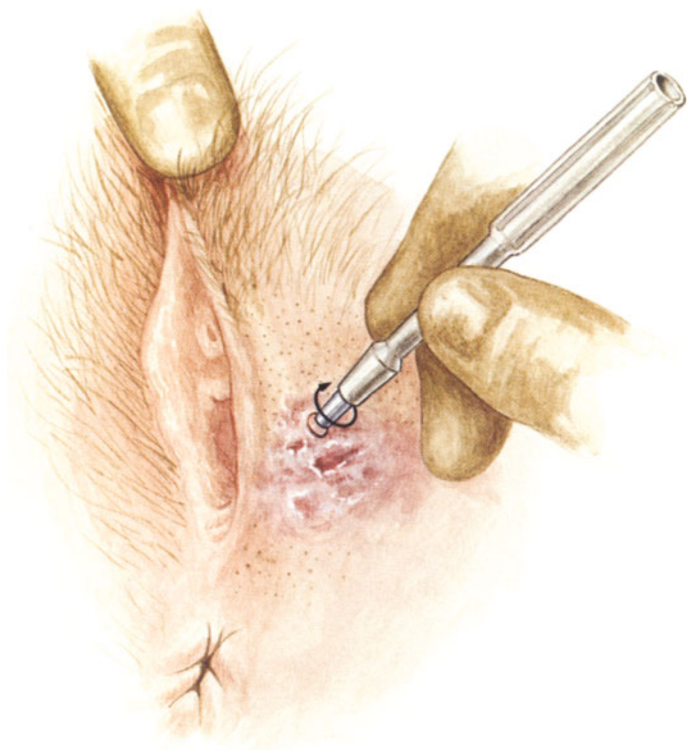


FIGURE 1-1. Dermatologic punch biopsy. With the patient in the lithotomy position, the skin is prepared with a povidone-iodine (Betadine) scrub of 1 minute. Use a small wheal to initiate anesthesia as the vulva has a significant number of nerve fibers, particularly around the area of the hymen and urethra. The skin is fixed with the hand so that the punch will clearly go through into the subcutaneous tissues without difficulty. A 3-mm dermal punch is directed into an area of the lesion that seems well vascularized. The punch is circled in a clockwise fashion until there is a release of resistance, indicating that the punch blade is in the subcutaneous tissues. Remove the punch.

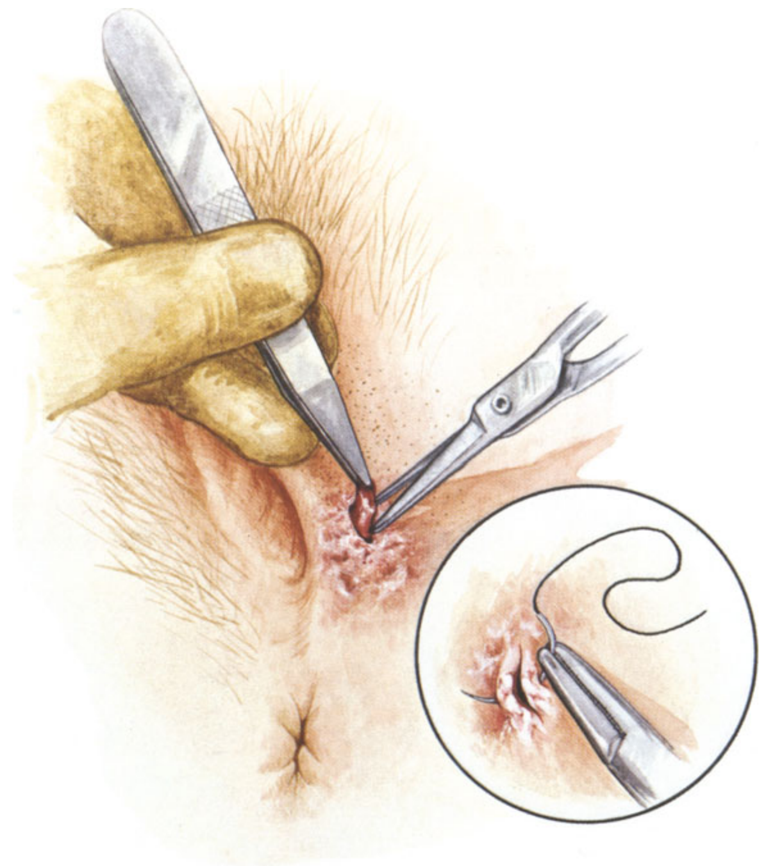


FIGURE 1-2. Pull the disk of tissue upward with the thumb forceps. The deeper portion is cut sharply with disposable scissors. *Inset:* Close the defect produced with 4-0 absorbable suture. No dressing is required.

On dismissal the patient is given separately packaged 4 × 4-inch gauze pads. Ice cubes in a disposable plastic bag will reduce the swelling, which accompanies most vulvar procedures, and pain. Most late bleeding can be managed at home with pressure. The patient is dismissed to return in 1 week after the pathologic examination of tissues has been completed. Any additional therapy needed for the vulvar lesion diagnosed by biopsy may be planned during the return visit.

Excisional Biopsy of Vulvar Lesions

Excisional biopsy is accomplished in a similar fashion (Fig. 1-3). In performing the excisional biopsy, remember that local anesthesia does not prevent the patient from perceiving traction as adjoining areas of skin are mobilized. Instruct the patient that she will have no pain but may have some sensation of the area being pulled upward.

Marsupialization of Bartholin's Gland

Infection of Bartholin's gland, which destroys the duct, is a common clinical occurrence. Such glandular epithelium continues to secrete until back pressure prevents further secretion, producing an encapsulated cyst. This cyst of Bartholin's gland lies just beneath the skin and is easily accessible for drainage. Simple drainage procedures have been employed for a number of years; however, the contracture of the stab wound obstructs the drainage site and the patient develops the cystic structure again, often with secondary infection leading to abscess formation. Marsupialization avoids resealing of the surgical

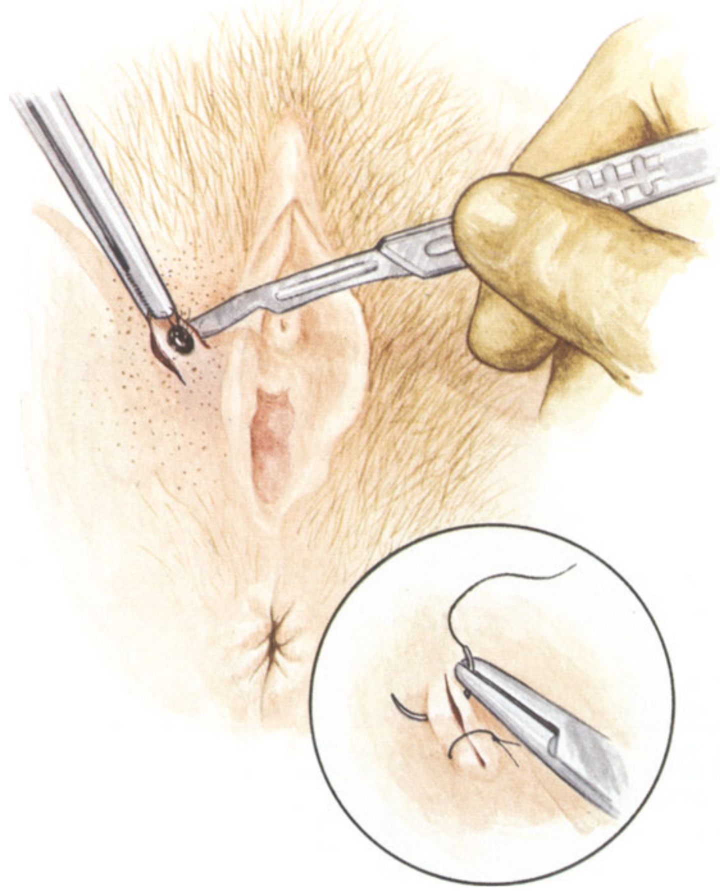


FIGURE 1-3. Excisional biopsy. Cut sufficient hair from the vulva to allow exposure of the wound area. With the patient in the lithotomy position, prepare the skin with a povidone-iodine solution (Betadine) and infiltrate 1% lidocaine (Xylocaine) into the base of the area to be excised with a disposable syringe and a 23-gauge needle. Allow 2 minutes for the anesthetic to take effect, then excise the area around the lesion. Two millimeters of normal-appearing skin should surround the lesion, and its base should be completely covered by underlying tissues. Bleeders in the base of the incised lesion will usually stop with pressure. Close the elliptical defect with a 4-0 chromic suture if mucosal or a monofilament nylon suture if on the cutaneous surface. Several small mosquito clamps should be available as the vulva is a very vascular area.

defect by careful suturing of the epithelium of the skin to the margin of the cyst wall, producing a sinus tract. Such incisions will greatly decrease the chance of recurrence and should be as large as the cyst wall will allow. The normal process of wound healing with contracture will diminish the size of the sinus tract and, if small, will obstruct its outflow (Figs. 1-4 and 1-5).

It is the intent of the procedure to produce a smooth epithelial surface. Crushing of the gland margin or the use of excessive suture material will incur scar formation with subsequent contracture and closing of the opening into the gland. A small sampling of the cyst wall may be obtained for pathologic examination and a biopsy of any solid nodules in the area should, of course, be performed. Ice cubes in a disposable plastic bag are useful to avoid additional pain from swelling. It is of interest that in a series of 700 lesions of Bartholin's gland treated surgically at the Mayo Clinic between 1910 and 1947, only 7 primary carcinomas were found, an incidence of 1%.[6]

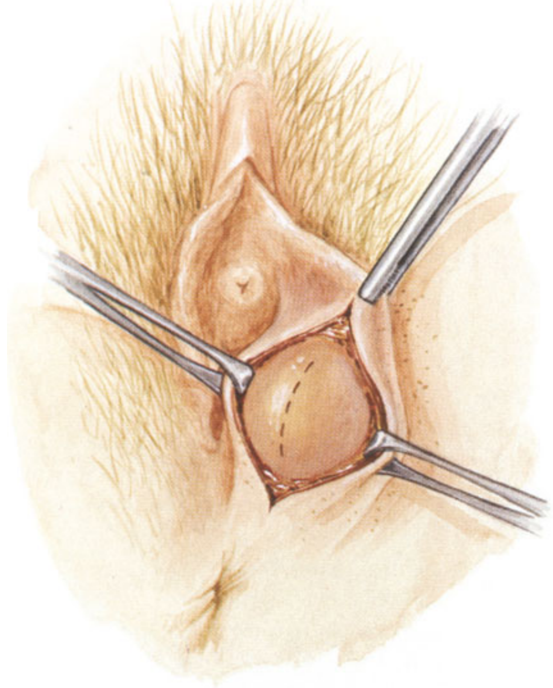


FIGURE 1-4. Marsupialization of Bartholin's gland. The patient is placed in the lithotomy position, the hair over the area to be incised is cut with scissors, and the skin over the cyst is carefully prepared with a povidone-iodine solution (Betadine). The area over the incision site is infiltrated with 1% (Xylocaine) and 2 minutes are allowed for the anesthetic to become effective. Advise the patient that she will feel some pressure. Using a sharp knife, incise the skin and the cyst to produce a 2- or preferably 3-cm defect.

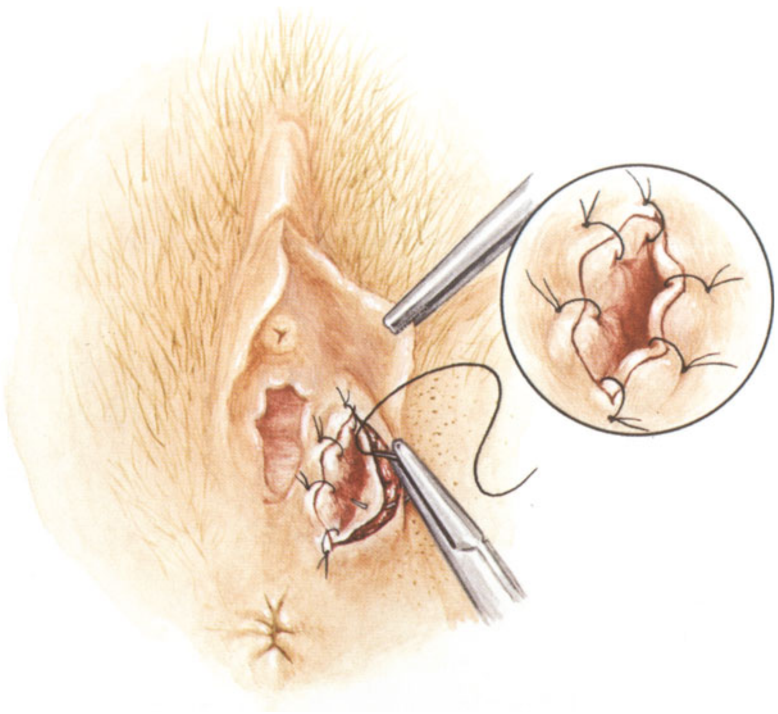


FIGURE 1-5. Grasp the margins of the cyst wall with a small mosquito clamp and suture the margin with 4-0 absorbable suture. The incision in the gland should be as large as practical to avoid stricture with subsequent reformation of the gland abscess. Should a large abscess be present initially, perform a simple incision as outlined without suturing the margins of the gland. No packs or drains are used in this wound. The patient is to return in 1 week.

Bartholin's Gland Abscess

In addition to Bartholin's gland cyst, patients may present with an acute abscess involving Bartholin's gland. Whether preceded by an infected cyst or an acute inflammatory process, the drainage procedure is, most often, all that can be done for these patients. Patients do have acute pain, and the purulent material in the abscess is often under some pressure.

The patient is placed in the lithotomy position and the skin over the cyst is prepared with a povidone-iodine (Betadine) scrub. After the area has been infiltrated with 1% lidocaine (Xylocaine), the gland is incised and a defect of 1 to 2 cm is produced. Although a No. 11 Bard-Parker knife is often supplied in the usual set for drainage of abscesses, the author prefers a blade with a rounded margin so that an actual incision of larger size may be made rather than a single small stab wound. Often margins of such a stab wound bleed owing to the acute inflammatory nature of the process; however, suture material is best avoided if possible. The patient will experience immediate relief of her discomfort.

Cultures of purulent material should be taken; however, they usually do not produce a discrete pathogen. The purulent material may have a most disagreeable odor, particularly if anaerobic bacteria have been prominent in the infection producing the abscess, and a large plastic bag should be immedi-

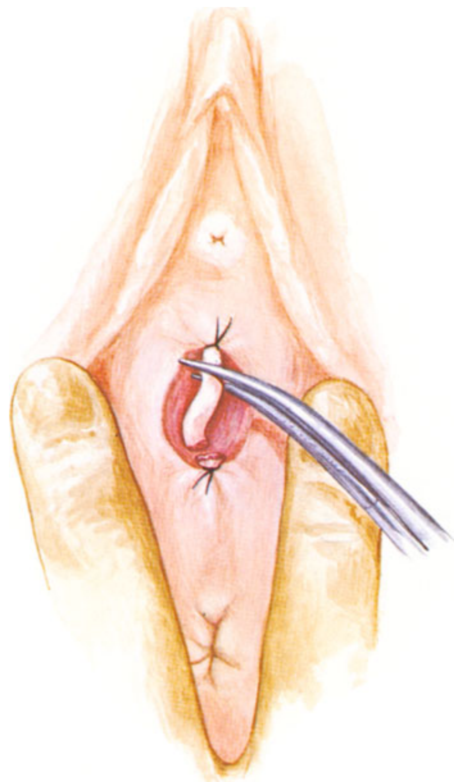


FIGURE 1-6. A common hymeneal abnormality is a simple strand connecting the anterior and posterior hymen. The area is scrubbed with a povidone-iodine solution (Betadine). Lidocaine (Xylocaine) jelly is applied over the mucosa, and the proximal segments are infiltrated with 1% lidocaine. After a 2-minute wait, 3-0 Vicryl suture is tied snugly about each end, and the intervening mucosal strip is excised.

ately available in which to place soiled dressings and sponges to minimize office odor. If significant cellulitis surrounds the abscess, an antibiotic should be administered for five days. Metronidazole is useful if the odor suggests anaerobic bacteria; however, drainage will produce prompt resolution without an additional medication in most patients. The patient may be instructed to apply hot soaks to the area to promote resolution of cellulitis.

Hymenal Lesions

Lesions of the lower vagina that require surgical intervention include abnormalities of the hymen. The hymen is richly endowed with a nerve supply but can be operated on under local anesthesia without difficulty (Fig. 1-6). Local anesthesia is also used in patients who have strictures after vaginal surgery or other hymenal abnormalities that are to be dilated. The patient is given a vaginal dilator—either a plastic syringe container or a manufactured dilator—for home use after the first dilation.

Imperforate hymen, while rare, does occur and should be treated; however, these patients need further diagnostic studies if a large pelvic mass has been produced by trapped menstrual fluid. A great amount of time and effort should be expended to minimize the psychological impact of this procedure in the adolescent female. She needs to be repeatedly told "she is normal" and steps need to be taken to ensure that this concept is reinforced at home.

Vaginal Ambulatory Surgery

With the increasing emphasis on preventive medicine, early vaginal lesions are being observed that formerly were often thought to be extensions of cervical or vulvar lesions. In Rutledge's series of 101 patients with primary vaginal cancer, 70 of the patients had invasive lesions with no previous history of cancer in the cervix or elsewhere, and 31 of the patients had in situ vaginal cancer.[43] It is important, therefore, to biopsy vaginal lesions and submit tissues for pathologic examination.

Biopsy of nodular lesions or lesions suspected of being malignant in the upper vagina may be done without any anesthesia, as the upper vagina contains few nerve fibers. The patient is placed in the lithotomy position and prepped with aqueous benzalkonium (Zephiran). Tischler biopsy forceps with a very sharp margin are used to good advantage in these vaginal lesions. If the lesion is mobile, it may be stabilized with a skin hook.

Duct cysts in the anterior vagina are also seen but should not be approached in the ambulatory patient because of the need for careful study to exclude upper urinary tract abnormalities. The cyst, unless symptomatic or associated with progressive upper urinary tract abnormalities, is best left alone.

Cervical Ambulatory Surgery

The number of available procedures for the management of cervical abnormalities has increased in recent years owing to technologic advancement (Fig. 1-7). Thermal cautery is rarely used today, and the crude biopsy forceps with tearing-type jaws are unsuitable for use in the patient who is awake and feels the traction of such pulling. As there are few nerve fibers in the cervix, procedures that do not disturb the endocervix may be accomplished without any supplementary anesthesia. The endocervix, however, contains numerous nerve fibers that transmit pain at the level of the internal os. Procedures that involve dilating the cervix require additional anesthesia.

Patients undergoing ambulatory procedures must have a diagnostic Papanicolaou smear performed during a prior office visit. It must be emphasized, however, that patients with a negative Papanicolaou smear may have a cervical malignancy. In the study by Maisel et al on the reliability of the Papanicolaou smear in the diagnosis of cervical cancer, it was demonstrated that 4.3% of the patients with a tissue diagnosis of cancer or atypical hyperplasia of the cervix had a negative Papanicolaou smear. This is particularly true in patients with advanced cancer of the cervix.[34] These data confirm the need for definitive cervical biopsies prior to cryosurgery or other cervical procedures when gross cervical abnormalities are noted.

Cervical Biopsy

The need for random cervical biopsies has decreased with the increasing use of colposcopic examination; however, patients who complain of bleeding following intercourse, spotting, have grossly visible lesions or a diagnosis of endometrial cancer require a cervical biopsy, as may those patients requiring colposcopically directed biopsy to confirm diagnosis.

To perform the cervical biopsy, very sharp, easily directed cervical biopsy forceps are essential (Fig. 1-8). The Kevorkian biopsy punch forceps are often suggested; however, the bite is small, the jaw is delicate, and they are, in the author's opinion, inadequate for general use. The author has used the Tischler-type forceps with a pistol-grip handle but has found the new Accupunch* forceps (Fig. 1-9) to be superior. This biopsy forceps with disposable cutting jaws has the decided advantage of a consistently sharp edge. A long needle holder, long thumb forceps, a supply of 00 chromic gut suture with a sharp needle, and long scissors are packaged in the surgical area.

* Accupunch ® Biopsy Forceps, Gyneco, Inc, 51 Chubb Way, Branchburg, NJ 08876.

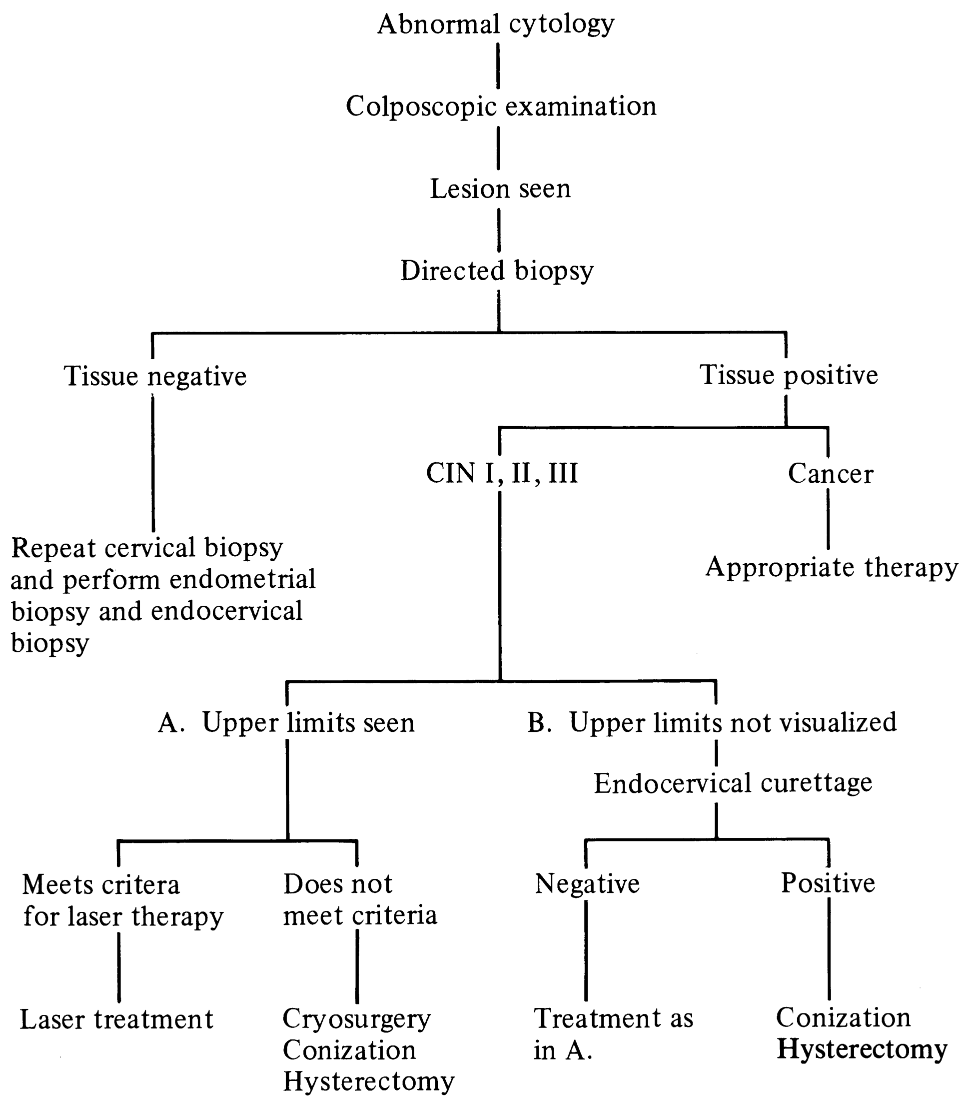


FIGURE 1-7. Schemata for management of abnormal cervical cytology after colposcopic examination during which lesion is seen. Adapted from Masterson BJ, Day TG Jr, Carlson JA Jr, Stone IK: Current status of laser therapy in gynecology. *J Ky Med Assoc* 1984; 82:562–566.

Cervical Polypectomy

Patients with a cervical polyp may have abnormal vaginal bleeding or excessive watery vaginal discharge. According to Aaro et al, endocervical polyps are rarely malignant, as demonstrated in their series of 1,009 patients in which only 2 patients had malignant polyps.[1] Nonetheless, the polyp should be excised and submitted for pathologic examination. In addition, the endocervix and endometrium should be studied by aspiration biopsy at the time of polyp excision.

With the patient in the lithotomy position, the cervix is prepared with aqueous benzalkonium and the polyp is removed with sharp biopsy forceps as described in the section on cervical biopsy. Frequently, however, the polyp may be of such size that the base cannot be grasped with the biopsy forceps. In this instance, a tonsil snare is quite useful; the wire is slipped into the cervix and passed about the base of the polyp, and the polyp amputated. It is again emphasized that the polyp may have produced no symptoms whatso-

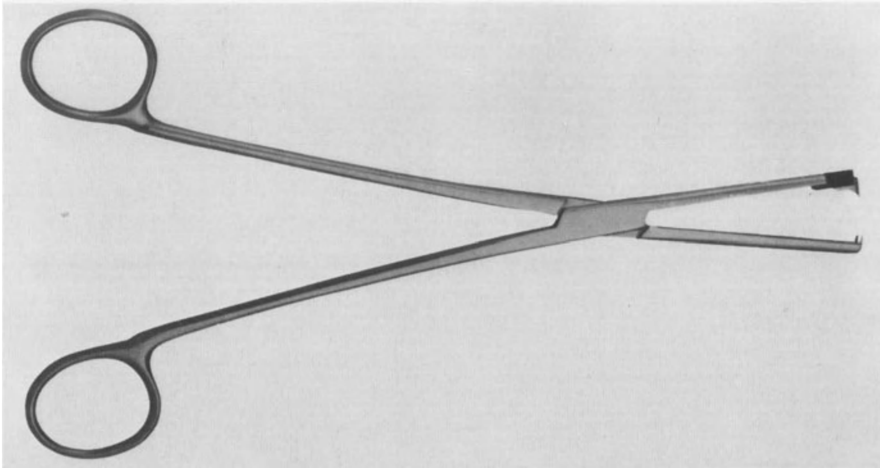


FIGURE 1-8. The Accupunch® Biopsy Forceps.

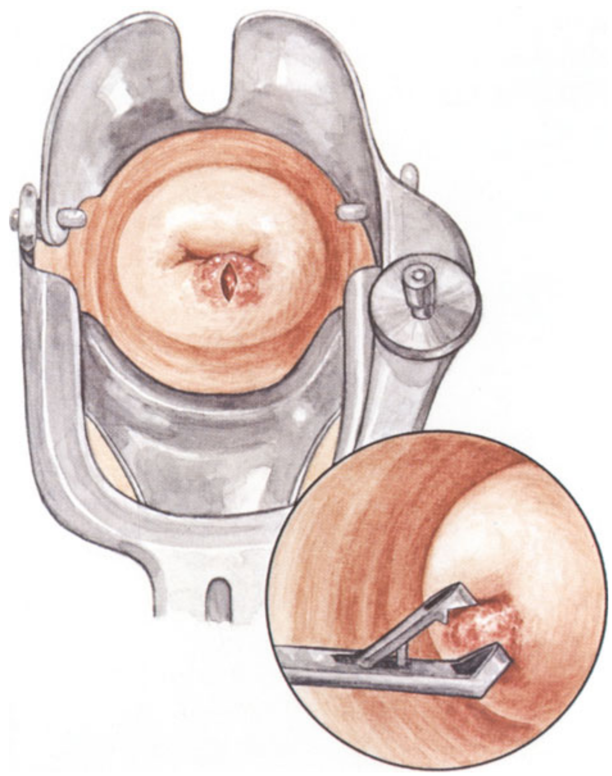


FIGURE 1-9. Cervical biopsy. The patient is instructed that she may feel some pressure but pain will be minimal. A vaginal speculum with an adequate light source is placed in the vagina, exposing the area to be biopsied. If Accupunch® or Tischler biopsy forceps are used, both of which have sharp pointed jaws, no tenaculum need be placed on the cervix. If other biopsy forceps are used, a tenaculum may be needed to stabilize the cervix. A biopsy of the lesion is performed with a large sharp bite of the forceps and the specimen is placed directly into formalin. Biopsies of multiple lesions may be obtained simultaneously and these must be individually identified. Unless a specific lesion is present, the areas at 3 o'clock and 9 o'clock are not used for routine biopsy sites as the descending branch of the cervical artery is present and bleeding will occur. If bleeding does occur, a suture may be placed in the ambulatory patient without difficulty. The patient is asked to return in 1 week for review of her biopsy findings.

ever and that the bleeding the patient experienced may be due to a lesion elsewhere in the uterus.

Cervical Strictures

Cervical strictures may be handled on an outpatient basis. If adequate egress is present for menstrual fluid, it is rarely necessary to dilate the cervix. The usefulness of dilation in dysmenorrhea is open to some doubt. If the cervix needs to be dilated in order to accept a small endometrial curette or other surgical instrumentation, anesthesia is provided as previously discussed.

Cryosurgery

Cryosurgery is the technique of causing cell death by freezing the tissues. The basic purpose of cryosurgery of the cervix is to destroy the cystic cervical glands; the epithelium then lies on the cervical stroma in the absence of the cystic structures, which tend to get infected and promote a persistent discharge.

Cryosurgery is effectively performed in the ambulatory patient and does not require local anesthesia. The patient is placed in the lithotomy position and a speculum is inserted into the vagina. The vagina and cervix are cleansed with cotton pledgets soaked in aqueous benzalkonium. The cryoprobe is placed in the area to be treated and the machine is turned on (Fig. 1-10). The duration

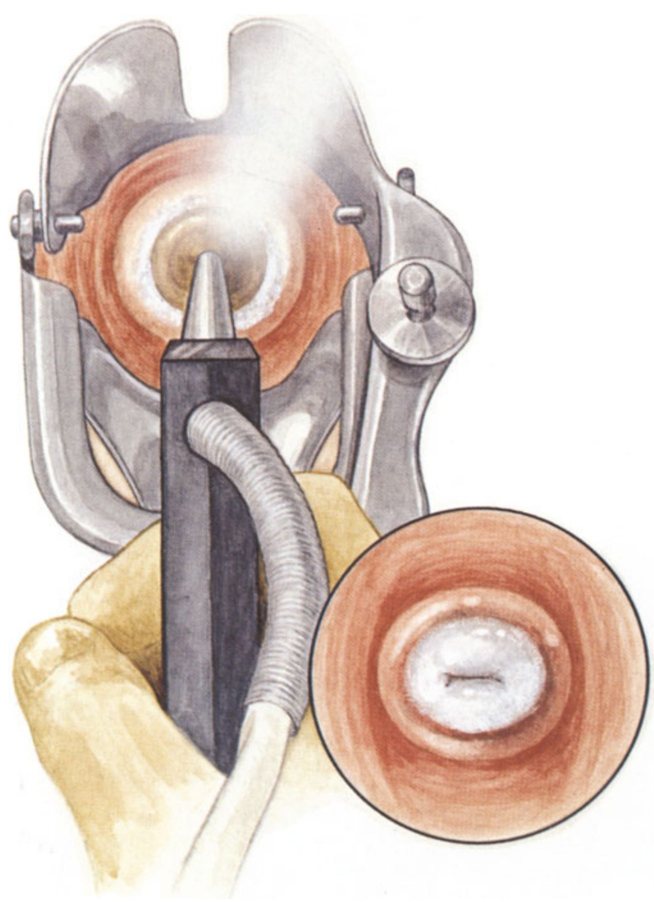


FIGURE 1-10. Cryosurgery. As large a speculum as possible is placed in the vagina to keep the vaginal epithelium from rolling in toward the cervix, which may become adherent to the probe. The probe is coated with K-Y jelly or some similar substance and is placed firmly against the cervix and turned on.

of the freezing differs according to the cryoprobe used and the lesion being treated; however, the purpose of the treatment is to destroy the lesion and to allow the freezing process to extend into the area of normal tissue. Application of water-soluble lubricant to the probe tip increases the freeze capability.[12] Average freezing time is two to three minutes. Once this is accomplished, the probe is defrosted and removed from the cervix.[47] Although some authors recommend a three-minute freeze, five-minute thaw, and three-minute freeze,[15,40] the author has achieved good clinical results from extending the hard freeze 4 to 5 mm beyond the diseased tissue.

Patients having cryosurgery are advised to avoid intercourse for 2 weeks and are instructed that a profuse watery discharge may follow. Such discharge may occur for approximately 6 weeks. Healing is aided by the application of oxyquinoline sulfate (Triva) or povidone-iodine antiseptic gel.

Take great care to avoid performing cryosurgery in patients with acute cervicitis and perimetritis. Administer antibiotics for 1 week prior to cryosurgery to avoid the development of acute pelvic inflammatory disease, which occasionally progresses to abscess formation.

Cryosurgery in the management of carcinoma in situ has been proposed by Creasman et al.[13,14] Such methods of management should be limited to those patients who are most reliable in their follow-up, as there is a significant incidence of recurrent cervical intraepithelial neoplasia in these patients. Cytology, colposcopy, colposcopically-directed biopsies, endocervical curettage, and pelvic examination are minimum diagnostic procedures required before outpatient therapy is initiated.[12]

Colposcopy

The colposcope, as described in Europe in the late 1920s by Hinselman, is a useful diagnostic instrument. The author prefers to use the colposcope to suggest areas where biopsy would be most informative. Although there have been innumerable symposia and seminars on the use of colposcopy held about the country, the key is still to confirm each diagnosis that involves a neoplastic process with tissue biopsy. Such biopsies should be large enough for the pathologist to orient, should include a nontraumatized full epithelial surface, and should be representative of the lesion observed. Sharp biopsy forceps that have been described previously are appropriate for this purpose.

There are several colposcopes available in the author's clinic for research, laser, and diagnostic purposes; however, a small stand-mounted colposcope is most useful in office practice. It requires no special wiring, occupies little space in the office, and may be easily moved from one examining room to another.

Colposcopic examination requires no special preparation. The patient should have had a cytologic examination prior to colposcopy, with the results available to the physician. There are several techniques described by Dexeus et al for the visualization of the cervical epithelium,[17] but the author prefers the following as a simple and rapid means of obtaining the maximum information.

The patient is placed in the lithotomy position for usual examination; the speculum is placed in the vagina after the examiner has carefully observed that no lesions are being hidden by the blades of the speculum; and the upper vagina is inspected for changes associated with diethylstilbestrol administration and other abnormalities.

The cervix is irrigated with 3% acetic acid using a small spray bottle, thus avoiding the trauma of constant swabbing with cotton pledgets. Following

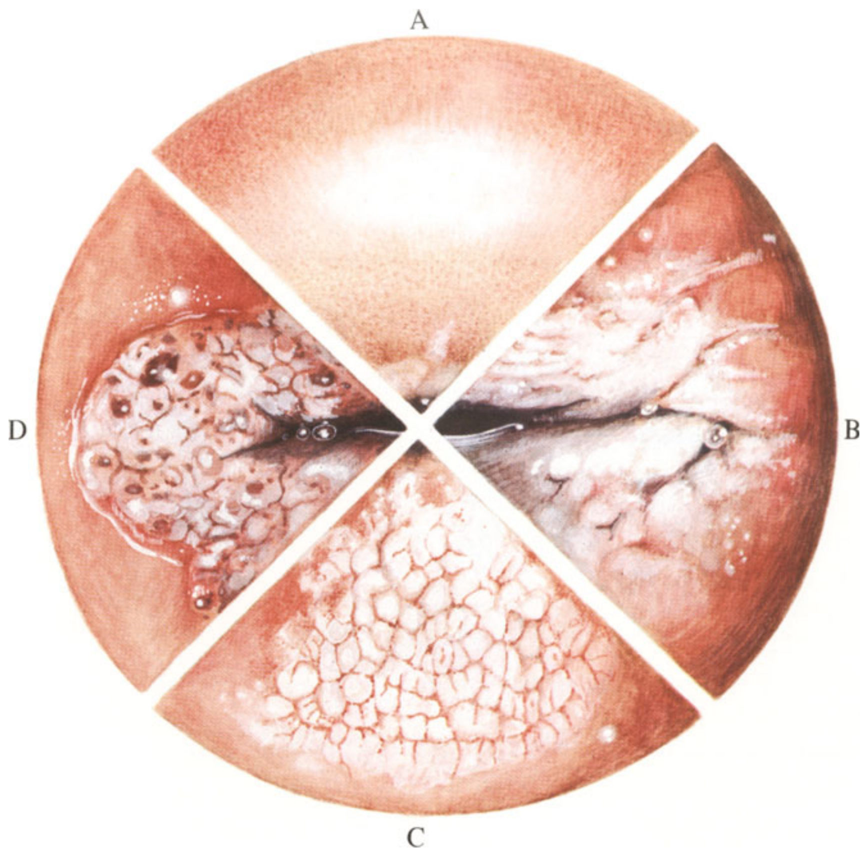


FIGURE 1-11. Changes seen on colposcopy. **A.** Normal cervical epithelium is transparent and glistening and overlies the small uniformly shaped capillaries. **B.** Cervicitis is recognized by the irregularity of the squamocolumnar junction with the nodularity produced by underlying cysts caused by an obstruction of the outflow of the mucus of the cervical clefts. The absence of any abnormal vessels and epithelial thickening is apparent. **C.** Mosaicism appears as tilelike plaques covering an area of the cervix. The abnormal vessels lying between these plaques are apparent and contrast sharply with the regular appearance of the cervical vessels. **D.** Grossly abnormal cervical vessels and epithelium should be biopsied. Colposcopic abnormalities suggesting malignancy are markedly tortuous and irregular vessels, thickened white epithelium of irregular consistency, and destruction of underlying stroma.

application of the acetic acid (approximately 30 to 45 seconds should be allowed for the full changes to occur in the cervix), the epithelium, where intraepithelial neoplasia is active, will become opaque. Repeatedly moisten the cervix as the examination is performed. The entire examination usually requires less than 10 minutes.

The normal components of the cervix to be noted in a colposcopic examination are the epithelium, the cervical stroma, the underlying vessels, and the transformation zone. The epithelium, in its normal state, is transparent until intraepithelial neoplastic disease occurs; it then opacifies, producing the changes illustrated in Fig. 1-11. It is important that the entire squamocolumnar junction be visualized. Aids to visualization include the endocervical speculum and the use of cotton swabs to hold up the anterior cervix. If the squamocolumnar junction is totally visualized, no further diagnostic studies are necessary, as documented in a recent study by Urcuyo et al.[50] In the absence of such visualization, it is mandatory to perform an endocervical curettage and conization should also be considered. The reader is referred to the text by Dexeus et al for an exhaustive presentation of the numerous colposcopic abnormalities from a histologic point of view.[17]

After the cervix has been carefully studied and the abnormalities noted, a drawing is made of sufficient size such that these areas may be carefully identified in the future. Representative biopsies are taken and labeled from the different sites of the cervix. A description of the epithelium, transformation zone, epithelial abnormalities, and character of the vessels should be noted.

The patient is instructed to return in 1 week for the results of the colposcopic biopsies. If no abnormalities are present, no additional biopsies need be taken, but if the patient has varying degrees of intraepithelial neoplasia or any other abnormalities, then obtain several biopsies. Small lesions are completely excised with the biopsy forceps, thus requiring no additional therapy. Bleeding from the biopsy sites may be treated with silver nitrate stick, a suture if necessary, vaginal pack, or a solution of ferrous subsulfate. (This is a caustic solution and should not be allowed to come in contact with the vaginal epithelium but only in the bleeding area of the cervix. It is most effective when the bleeding site is as dry as possible when the solution is applied.)

It is again emphasized that liberal use of the colposcopically-directed biopsy will greatly improve the management of cervical intraepithelial neoplasia in the ambulatory gynecologic patient. The neglect of biopsies in favor of colposcopic examination alone will produce clinical disasters because some crucial lesions will be missed in their earliest states.

Laser Application in Gynecologic Surgery

The principal application of laser therapy in gynecologic surgery is tissue destruction. It can also be used for making incisions, tissue dissection, excision, vessel coagulation, and tissue vaporization. The major clinical application in gynecologic surgery is the treatment of nonmalignant, multiple lesions for which rapid vaporization is appropriate. These include condylomas and precancerous lesions of the cervix, vagina, and, where applicable, vulva. Bartholin gland cysts, pedulated tumors, and other specific incisions may be done with the laser. The carbon dioxide (CO_2) laser also has been used for conizations and has produced acceptable specimens with minimal side effects.[3,32]

The author's clinic uses the CO_2 laser. Its activity is directed by a small orange dot that is moved about the cervix with a small director that focuses the split beam on the vaginal lesion (Fig. 1-12). Lesions are reduced to carbon dioxide and oxygen with no residual; therefore, should a virus genome or other abnormality be in the nucleic acids, no residual remains to produce neoplastic change. Areas so treated are very dry. Specific techniques and

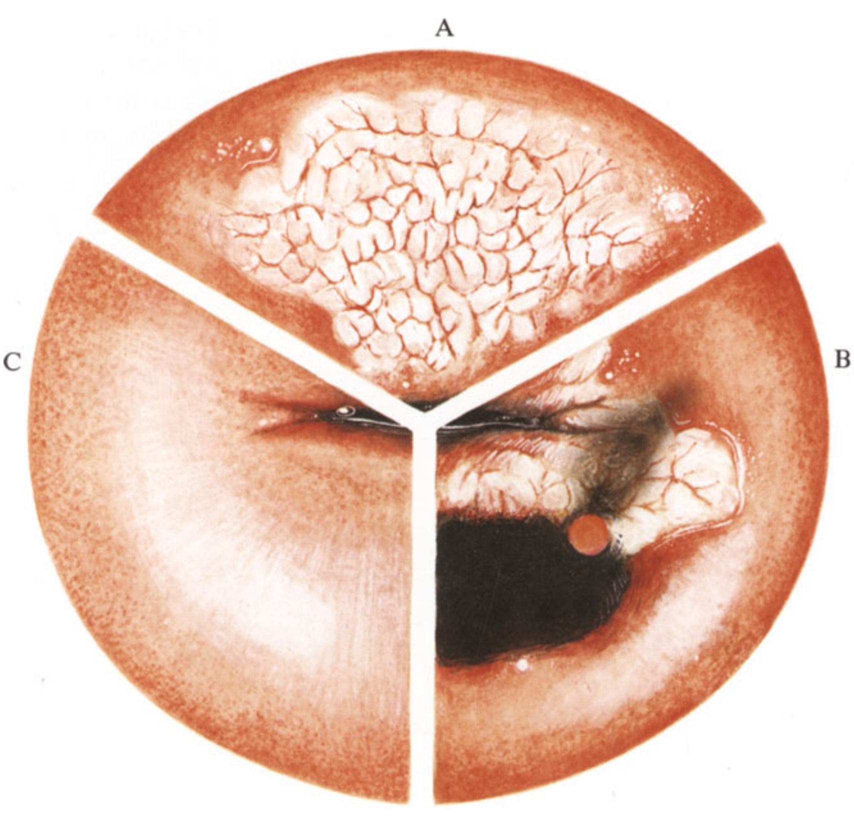


FIGURE 1-12. Carbon dioxide laser therapy. **A.** This cervix has abnormal epithelium at the squamocolumnar junction. These lesions will histologically appear as severe dysplasia. **B.** The laser is usually operated in a continuous fashion at 15 to 25 watts for treatment of the cervix. The cervix should be vaporized from 5 to 7 mm deep to a level extending beneath the depth of the largest cervical gland. **C.** View taken 6 weeks after laser therapy shows the destruction of the abnormal epithelium. Such areas must be carefully followed with colposcopic and confirming cytologic examinations.

treatment times depend on the specific instrument used, and such data must be completely studied before the laser is used.

A comment must be made regarding diethylstilbestrol patients. It is the author's belief that these patients are overtreated. With the infrequent development of clear cell cancers in these patients, an estimated 0.1 to 1 in 1000,[26] there is little reason to treat the upper vaginal tract, and observation is sufficient. There is no current evidence to suggest that the laser should be used to remove areas of adenosis in the upper vagina, and the author does not recommend it for this purpose.

While the laser is an increasingly useful treatment modality, there are limits to its application. Most incisions can be performed more quickly with a scalpel. Moreover, laser treatment produces little specimen for pathologic examination. Therefore, the use of the laser for local excision of small vulvar lesions should be limited to those of known microscopic type. Suspicious pigmented lesions always need sharp excision. The laser also is limited in its ability to coagulate vessels larger than 1 mm. Even the diffused CO_2 laser cannot coagulate vessels much over 1 to 2 mm in diameter. This limits the laser's efficiency in the rapid excision of large lesions.

The laser's most important limitation is its effect on the dynamics of the wound-healing process. The author recently completed the first of several studies on tissue interactions, focusing particularly on wound healing.[45] Figs. 1-13 and 1-14 show the difference between the scalpel and the thermal knives on two parameters of the wound-healing process. Note the marked interference produced by the thermal knives.

Each type of laser has different effects on tissue. Thus, tissue response to every new laser beam must be carefully studied and evaluated before its clinical application.

Condyloma Acuminata

Increasing numbers of patients with condyloma acuminata are being seen throughout the United States.[11] This increase has occurred in vulvar, vaginal, cervical, intraurethral, and anal condyloma. Since Goldman and Rockwell[22] first reported the use of the laser in skin lesions, management of condyloma acuminata with the carbon dioxide laser has gained wider acceptance. Studies

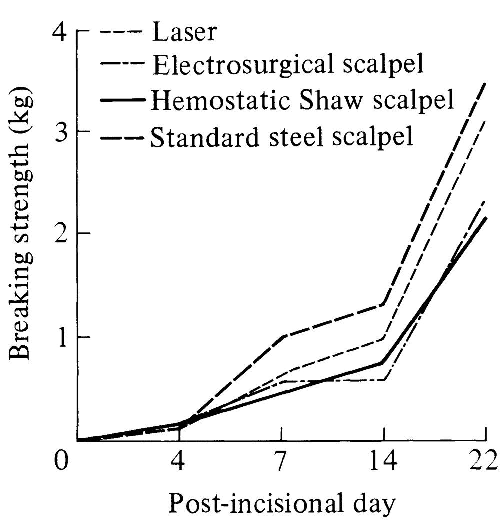


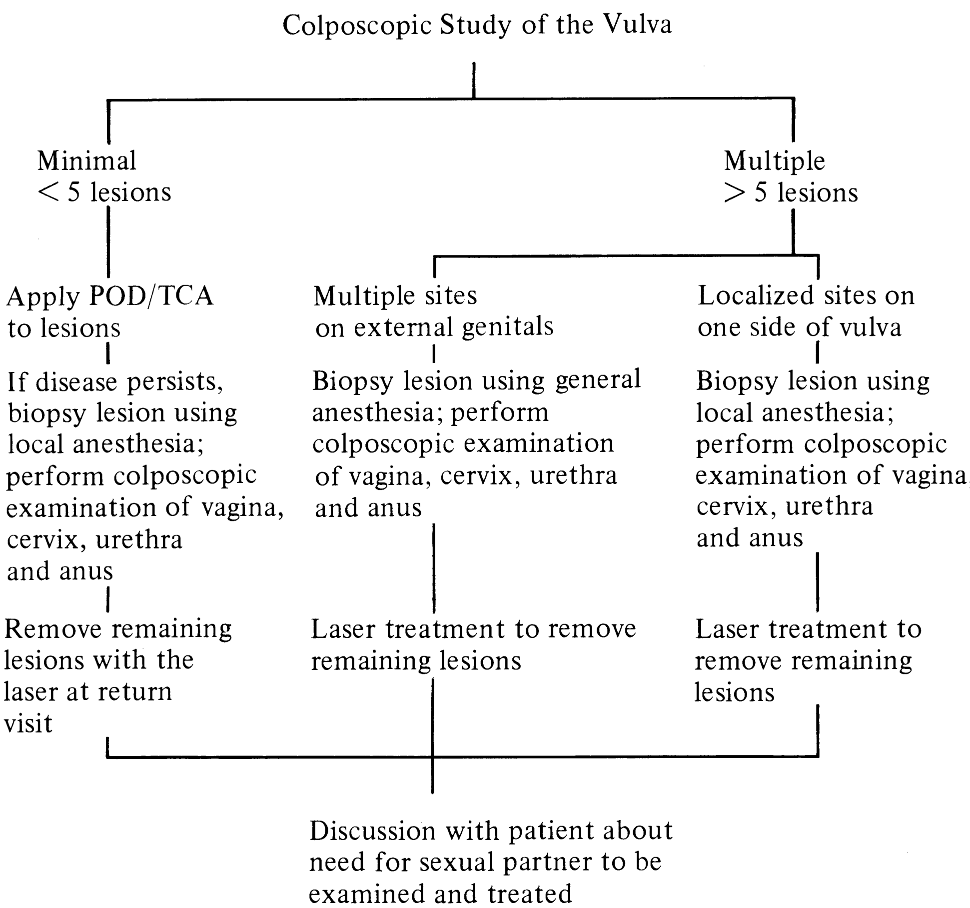
FIGURE 1-13. Mean breaking strength of wounds.

Instrument	Post-Incisional Day				
	1	4	7	14	22
Standard steel scalpel	+	+	+	+	+
Hemostatic Shaw scalpel		+	+	+	+
Electrosurgical scalpel			+	+	+
CO_2 laser			+	+	+

FIGURE 1-14. Re-epithelialization of wounds by incisional instrument.

of small series have indicated success rates as high as 100%.[36] Other studies, including the author's, report recurrence rates of 5% to 5.5%[2] and 9%.[9]

In the past, clinical observation alone was sufficient to diagnose condyloma acuminata. The warty appearance of these lesions is certainly characteristic and well known to the experienced observer. However, an increasing number of patients with Bowen's disease have clinical appearances similar to that of condyloma.[33] The histologic findings of five such cases have been described by Pincus et al.[41] A management scheme for condyloma currently used by the author (Fig. 1-15) incorporates liberal use of biopsy to avoid confusion in diagnosis.



1. Individualize care for pregnant patients.
2. When multiple lesions present, biopsy each lesion of a different morphologic appearance.
3. Suggest condoms for one year.

FIGURE 1-15. Schemata for management of condyloma acuminata with outpatient laser therapy. Adapted from Masterson BJ, Day TG Jr, Carlson JA Jr, Stone IK: Current status of laser therapy in gynecology. *J Ky Med Assoc* 1984; 82:562–566.

In the early stages of development, Buschke-Lowenstein carcinoma may be clinically confusing. Its progressive nature and local invasion make the early diagnosis of this difficult lesion clinically important. Wide local excision is vital in the management of this lesion, and, unfortunately, the role of the laser in such cases is currently limited. If the patient's symptoms resemble those of a routine case of condyloma acuminata, yet fail to respond to usual treatment methods, Buschke-Lowenstein carcinoma should be suspected. Goltz's syndrome, with vulvar and perianal angiofibroma, also may clinically resemble condyloma. Therefore a biopsy of two of the more active-looking condylomas is advisable. A vaginal smear obtained prior to treatment is recommended because of the presence of the virus in both the cervix and vagina of patients with condyloma and because of its association with cervical intraepithelial neoplasia (CIN). Careful colposcopic examination of the cervix will frequently reveal these or other changes. The importance of these coexisting changes is demonstrated by the high incidence of condyloma virus detected both in patients with clinically confirmed condyloma and in those with clinically confirmed CIN unrelated to condyloma.

When the laser is used for lesions in the anal canal, the operator must always be cognizant of the explosive properties of methane gas. Since the laser is capable of igniting methane gas, the suction unit should be placed above the area being treated to minimize possible problems.

The areas to be treated are first cleansed with aqueous benzalkonium solution after the patient has been placed in the lithotomy position. The base of the vulvar lesions and those in the lower one half of the vagina are then infiltrated with a 1% solution of lidocaine. Placement of the needle under colposcopic control is useful. Observing through the colposcope at low magnification, the surgeon directs the laser toward the lower lesions. With a 10-W continuous mode setting, and all safety measures observed, the condyloma are destroyed in a clockwise fashion from the bottom, working upward. A small nasal speculum provides easy access to the urethra and anoscopic evaluation is advised as well. All male partners should be examined, with particular attention to the urethra and shaft of the penis.

Should the patient raise her head in an attempt to watch the procedure, a misdirected laser beam could strike her eyes. Therefore, she should be wearing safety glasses and be warned not to look downward while the procedure is being performed. To reduce the chance of such an occurrence, the laser beam is always directed in a downward fashion when treating the upper vulva.

Removal of the condyloma with the laser continues until the skin appears normal. Rarely does significant bleeding occur. Any carbonized material should be removed to make certain that the base of the condyloma has been carefully treated. Calkins and Masterson[9] have reported a 91% success rate with the treatment program as described. Patients who are immunosuppressed because of organ transplants and diabetic patients are among the most resistive to treatment by this or other methods.

To ensure the most effective treatment program, other methods of management may be used in concert with the laser. 5-Fluorouracil is useful for intraurethral lesions; trichloroacetic acid may be used locally as well. Unlike podophyllin, trichloroacetic acid produces no abnormalities on absorption. Podophyllin, though widely used clinically, does produce significant distortions of histologic appearance, considerably reducing the value of biopsy for 4 to 6 weeks. Absorption of large amounts of this product through the vaginal wall also may produce neurologic lesions in the patient and significant defects in any developing fetus.[39]

Cervical Intraepithelial Neoplasia

The most commonly accepted use of the CO_2 laser in gynecologic surgery is the management of CIN. Two major techniques, vaporization and laser excisional cone, can be used. Recent reports on vaporization indicate success rates of 96%,[3] 90%,[34] 87%.[8] The choice of laser excisional cone is primarily determined by the extent of disease, unsatisfactory diagnostic reports, and failure of previous treatments. Recent studies of the effectiveness of laser excisional cone have reported a 96%[3] success rate. When laser excisional cone is compared with conization by cold knife, there is a significantly lower incidence of bleeding complications and a lower rate of blood loss.[3,32] With these results, this laser procedure may gain wider acceptance.

If laser therapy is used, the lesion should be entirely visible with the colposcope, be of known histologic type, and occur in a patient who is likely to comply with follow-up instructions. Patients with lesions extending into the endocervical canal, or with possible microinvasive or invasive cancer, are not candidates for laser therapy. Fig. 1-7 is the author's scheme for managing patients with abnormal cervical cytology.

The author's original treatment programs called for treatment of the lesion to a depth of tissue weeping, approximately 1 to 2 mm. Later protocols specified the initial treatment of the entire transitional zone. Studies of the correlation between recurrence rates and the depth of excision have demonstrated that 5 mm of tissue should be excised.[35] With this depth, all of the cervical glands with possible downgrowth of epithelium and extensions of cervical intraepithelial neoplasia will be excised. The author's current protocol specifies the excision of the entire transitional zone to a depth of 5 to 7 mm and other laser surgeons report similar protocols.[3,8]

The patient is placed in the lithotomy position, the speculum inserted, and the cervix visualized. After the cervix is sprayed with 3% acetic acid, the surface is carefully restudied. At this time previous colposcopic examination records and biopsy reports should be reviewed; criteria for the acceptability of laser treatment should be established again; and any pretreatment photographs should be taken.

The laser is set to produce 25 W of power on continuous mode where the spot size is 0.8 mm, which will produce a power density of greater than 4,000 W/cm^2 (*Sharplan Equipment Manual,* Laser Industries Ltd., Tel Aviv, Israel, 1980). This setting allows the rapid destruction of cervical tissue. After all safety measures have been reviewed and completed, the smoke evacuator is turned on. The helium neon guide laser is then directed onto the cervix, and an initial burst of laser energy is released. Once the accuracy of the aiming laser is reaffirmed, surgery may begin. If all systems are working acceptably and safety measures are completed, the surgeon should outline the lesion to be excised. A 2-mm margin of normal-appearing epithelium between the lesion and the outlining laser beam should be included. In a stepwise fashion the beam is moved from right to left and from below upward. All the tissues included in the transitional zone are then excised to a depth of 5 to 7 mm. Continuous evacuation of smoke must accompany this procedure.

The depth of the excision is measured with a small segment of plastic millimeter rule held in an intrauterine dressing forceps. Any ridges or incomplete areas of excision are removed, and the area is inspected again. Carbonized areas that obscure this examination should be removed, and a detailed examination made as to the completeness of tissue destruction.

Vaginal Intraepithelial Neoplasia

Laser therapy of vaginal intraepithelial neoplasia appears to be an effective treatment modality. A recent study reported two failures out of 15 patients.[10] Another reported that in 92% of the patients the lesions were completely removed.[48] When using the laser to treat vaginal intraepithelial neoplasia, the physician and the patient must recognize that few long-range studies have been reported. Multiple treatments may be necessary and, certainly, frequent and prolonged follow-up is essential. If a patient continues to have progressive disease or fails to respond to laser treatment, one of the more conventional methods may be considered.

Vaginal intraepithelial neoplasia may be suspected with an abnormal Papanicolaou smear and no apparent cervical or endocervical abnormality. Usually the colposcopist would scan the vagina in any regard, but would be much more thorough where vaginal lesions are suspected. Sometimes the lesion may be in continuity with the cervical intraepithelial process. In other instances it may exist alone or in multiple locations. The vaginal epithelial abnormalities are similar colposcopically to their cervical counterparts. Repeat biopsies should be taken. This can usually be accomplished under direct vision without anesthetic in the upper third of the vagina. A local anesthetic is recommended when the lower vagina is approached.

To avoid deep tissue removal, the laser voltage is reduced to 5 W when treating intravaginal lesions. It is important to remember that there are no glands in the vagina, and removal of 1 to 2 mm of epithelium is sufficient. The vesicovaginal septa or rectovaginal septa may be no thicker than 3 to 5 mm in some patients. Therefore, removal of the 5 to 7 mm of tissue, as in laser treatment of cervical intraepithelial neoplasia, would obviously enter these organs.

Vulvar Intraepithelial Neoplasia

Laser treatment for vulvar carcinoma in situ has been gaining acceptance as a conservative therapy. Two recent studies report good results, with success rates of 91%[4] and 94%.[49] An important advantage of this technique is that it allows the preservation of the vulvar anatomy.

Vulvar intraepithelial neoplasia may appear as a white lesion or in a variety of fashions, depending on the superimposed trauma from scratching and infection. Edema and prior treatment may obscure the neoplastic process. Punch biopsies are always required for accurate diagnosis. Both sides should be biopsied when more than one side is affected.

If the lesion is of unquestionable diagnosis and can be isolated, superficial removal with the laser is acceptable. The operator should remember, however, that when the lesion is thickened or of an obscure character, vaporization with the laser eliminates the specimen and may contribute to mismanagement in the event of a coexisting microinvasive carcinoma or other lesion.

Clinic Organization for Outpatient Laser Treatment

The single most important factor in a successful, efficient laser clinic is the nursing personnel. Patient compliance with postlaser treatment instructions and follow-up education are increased by an attentive nursing staff.[51] To ensure equipment performance, one staff member should have responsibility for maintenance and compliance with safety measures (Fig. 1-16). Correlation of cytologic and pathologic reports, record keeping, adequate provision of supplies, and record retrieval need to be coordinated to enhance the smooth operation of the laser unit.

Uterine Ambulatory Surgery

In view of the increasing interest in the early diagnosis of endometrial cancer, it is fortunate that access to the uterine cavity is readily available. The diagnos-

Operator

1. A skilled colposcopist and knowledgeable in neoplastic disease
2. Reviewed all cytologic and biopsy data
3. Knows precise extent and histologic type of disease present
4. Experienced in using equipment
5. Understands and observes all laser safety precautions

Patient

1. Well informed about laser procedure
2. Understands other treatment options
3. Has given consent by signing the informed consent form
4. Will comply with follow-up examination schedule

Lesion

1. Noninvasive
2. Entirely visible
3. Thoroughly studied and sampled
4. Appropriate for laser therapy

Laser equipment

1. Appropriate for task to be performed
2. Properly maintained and in good working order
3. Incorporates proper safety features

FIGURE 1-16. Safety check list for gynecologic laser surgery. (Adapted from: Masterson BJ: Techniques of laser colposcopic surgery. In Goldman L (ed): The Biomedical Laser: Technology and Clinical Applications, pp. 107–115. New York, Springer-Verlag, 1981.

tic procedures outlined below are quite amenable to the ambulatory patient and facilitate frequent investigation of the endometrium.

Uterine Sound

A common procedure performed in the ambulatory gynecologic patient is the placement of a uterine sound. The procedure is preceded by careful palpation of the pelvis to determine the direction of the uterus and its cavity. No preparation or anesthetic is needed, but the patient is advised that she may have a sensation of cramping. The sound should be one that bends and can be directed to conform to the uterine cavity. The sound should have centimeter marks on it so that the distance in the uterus may be carefully measured. The presence of small submucous fibroids or uterine cavity abnormalities and the presence or absence of the uterus in a pelvic mass can be determined by this simple technique.

Endometrial Aspiration Biopsy

The endometrial aspiration biopsy is a simple, relatively painless, inexpensive, and accurate technique for histologic diagnosis of endometrial abnormalities. It has essentially replaced dilatation and curettage as a diagnostic measure. Successful biopsy is anticipated in 89% of patients,[19] and a 96.2% accuracy rate has been reported.[20] The Papanicolaou smear cannot be relied upon for screening of endometrial cancer, as documented by Burk et al,[7] making this additional study mandatory in the patient over the age of 30 with abnormal bleeding, in the patient receiving estrogen, and in other groups at risk for endometrial cancer. A recent study by Bibbo et al compared vacuum-assisted biopsy of the endometrium, endocervical aspiration, and endocervical smears.[5] Detection results were correlated with available dilatation and curettage (D & C) or hysterectomy specimens. Endometrial biopsy detected 100% of the adenocarcinomas whereas the cytologic methods detected only 67%. All cases of atypical hyperplasia and 86% of the adenomatous hyperplasias were detected by endometrial biopsy. Only 6% were detected by cytologic methods. Contraindications are cervical stenosis, pregnancy, and acute or subacute pelvic inflammatory disease.

The author prefers an endometrial diagnostic device of his own design* to obtain tissue from the endometrial cavity (Fig. 1-17). This device consists of a lightweight hand-held suction unit incorporating a disposable collection chamber with an attached narrow-gauge malleable curette. The curette has a sharp cutting edge on three sides protected by a rounded tip for safe insertion. The shaft of the curette is marked in centimeters so that it may be used simultaneously as a sound. In a study of 50 patients, biopsy specimens adequate for histologic diagnosis were obtained from 47 patients by means of a Masterson unit.[42] The remaining three specimens were found to contain representative tissue upon follow-up D & C.

There is no need for a cervical tenaculum if the direction of the cavity is easily determined, but if marked retroversion or anteversion is present, a tenaculum may facilitate curette introduction (Fig. 1-18).

* Masterson endometrial diagnostic device, Gyneco, Inc, 51 Chubb Way, Branchburg, NJ 08876.

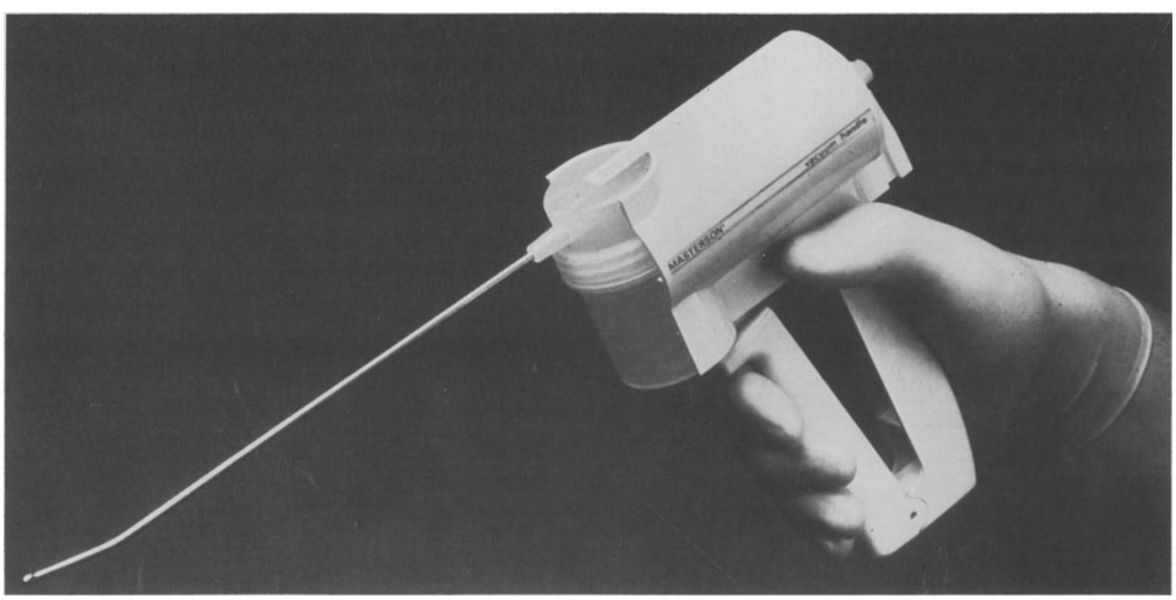


FIGURE 1-17. The Masterson endometrial biopsy unit.

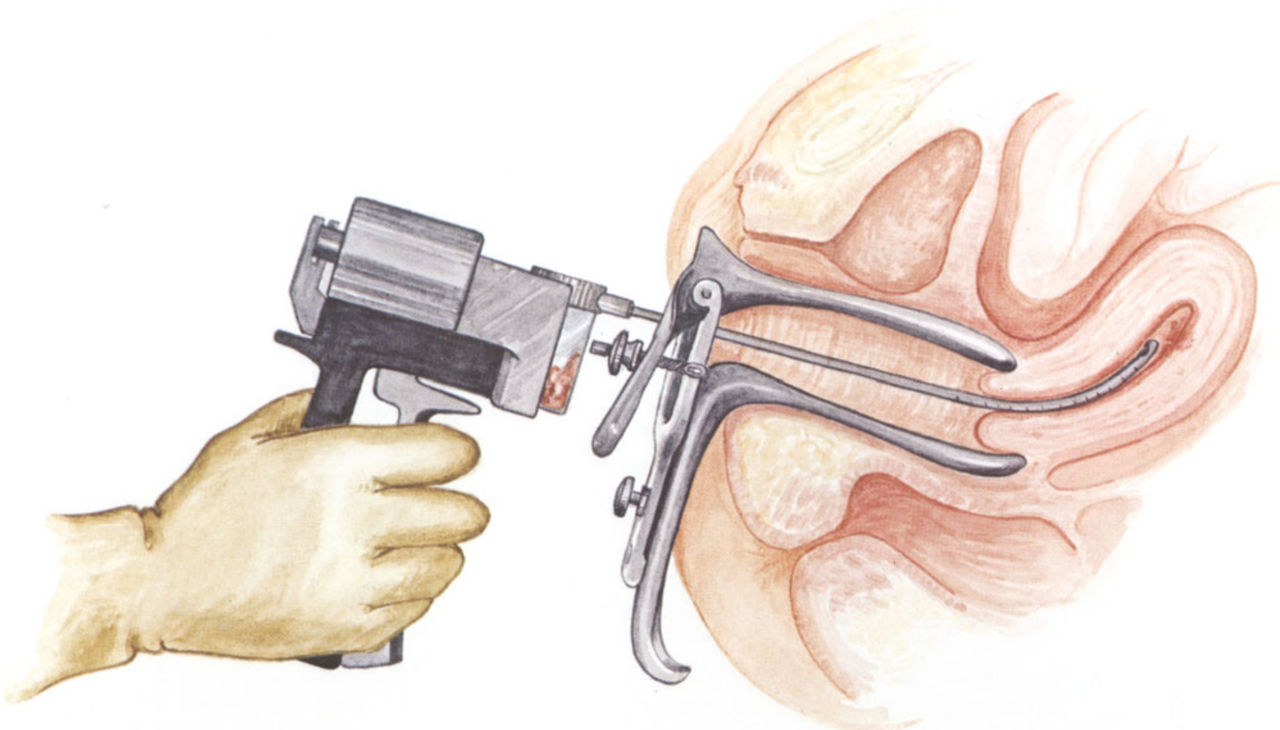


FIGURE 1-18. Endometrial aspiration biopsy. Gently insert the curette after determining the direction of the uterus by palpation and cleaning the cervix with povidone-iodine (Betadine) or aqueous benzalkonium (Zephiran). Note the uterine depth in centimeters and remove and bend the cannula as needed to conform to the uterine position. Move the curette downward systematically through all four quadrants of the uterine cavity while repeatedly compressing the handle. Observe the tissue collecting in the container. When a thorough investigation is complete, remove the device and aspirate fixative to recover any tissue in the curette. Remove the collection vial, place the vial cap, and discard the curette unit.

Endometrial tissue analysis is preferable to cytologic study as it provides greater diagnostic accuracy, particularly in precursor lesions, and has a much lower false negative rate. Two millimeter cannulas make biopsy available for the older patient with a small atrophic cervix.

If no tissue is obtained with aspiration biopsy, one will rarely find any tissue with a D & C. Jonas showed excellent correlation between outpatient endometrial aspiration biopsy without anesthesia and inpatient D & C under general anesthesia.[28] Ferenczy et al documented a 96.2% accuracy rate of endometrial biopsy when controlled by a D & C or total abdominal hysterectomy.[20]

The usual patient who has irregular bleeding will not need evaluation with a hysteroscope. Ninety-five percent of uterine bleeding abnormalities can be evaluated with endometrial biopsy alone. If needed for infertility evaluation or other purposes, hysteroscopy is a useful outpatient diagnostic technique (see Chapter 3).

Goldwrath however recently performed endometrial biopsy in conjunction with office hysteroscopy in 406 patients.[23] The combination produced an accuracy greater than the classic D & C and was performed in the office. He used a para-cervical block for local anesthesia in 372 of these cases. Forty-five percent of all the patients had a significant hysteroscopic finding. Failure to complete the procedure occurred in only 6 patients and no infections or perforations were noted. This combination of hysteroscopy and endometrial biopsy may point the direction toward more precise tissue sampling and diagnostic accuracy in abnormal uterine bleeding.

Dilatation and Curettage

The safety of D & C on an outpatient basis is well established. Kennedy noted no serious complications in 1,000 office curettages,[31] and its use was emphasized as early as 1925 by Kelly.[30] Mengert and Slate[38] and Daichman and Mackles[16] have also reported sizeable series of D & Cs performed on an outpatient basis without significant injury. Curettage is used mostly for complications of pregnancy such as incomplete abortion or in those patients who need associated cervical dilatation.

No shaving is necessary and if the no-touch technique is used, extensive draping is not required. Premedication consisting of meperidine hydrochloride (Demerol), 75 mg given as the patient arrives in the operating area, is useful. A povidone-iodine preparation of the perineum and vagina is done prior to insertion of the weighted speculum. When indicated, cervical biopsies are done after the tenaculum is placed on the cervix.

The paracervical area may be infiltrated with 5 mL of 1% lidocaine without epinephrine to block pain sensation from the endocervix. A brief period of discussion with the patient after its injection will serve to reassure the patient and allow time for the local anesthetic to become effective. Sound the uterus and record its depth. Dilate the cervix to accept a medium-size dilator and in turn a medium-size curette, and curette the cavity. Bend the curette to conform to the uterine sound, which has previously been made to conform to the direction of the uterine cavity (Figs. 1-19 through 1-21).

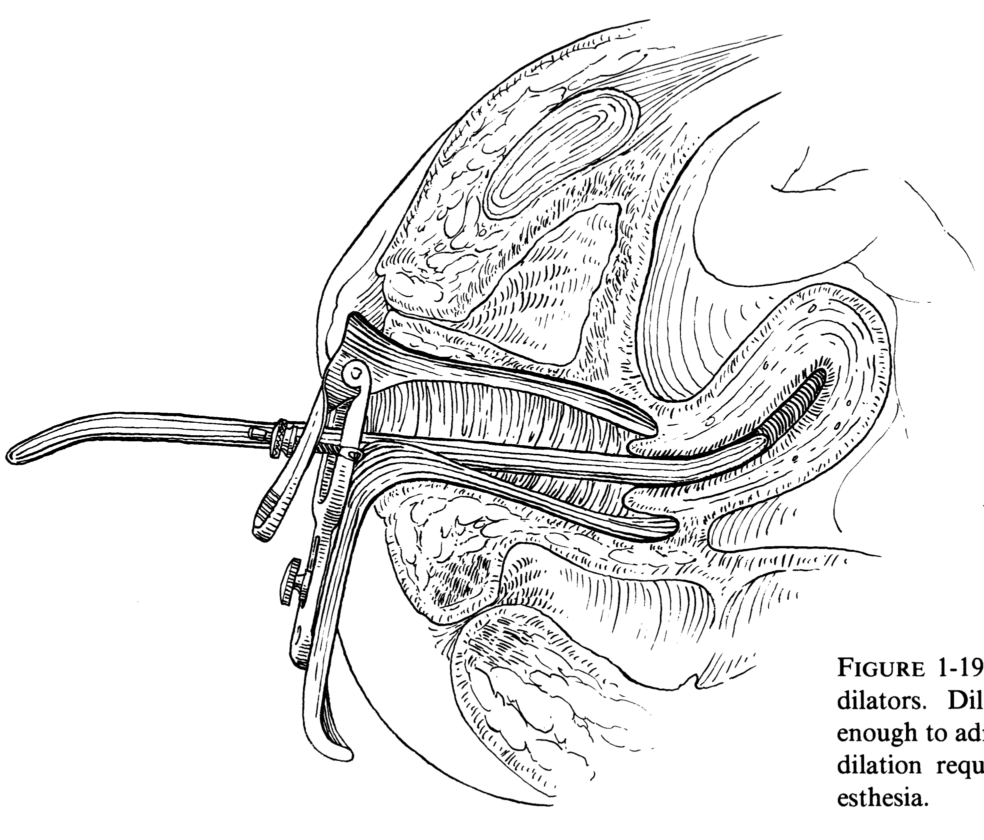


FIGURE 1-19. Dilate cervix with graduated dilators. Dilation needs only to be large enough to admit a curette. Significant cervical dilation requires either local or general anesthesia.

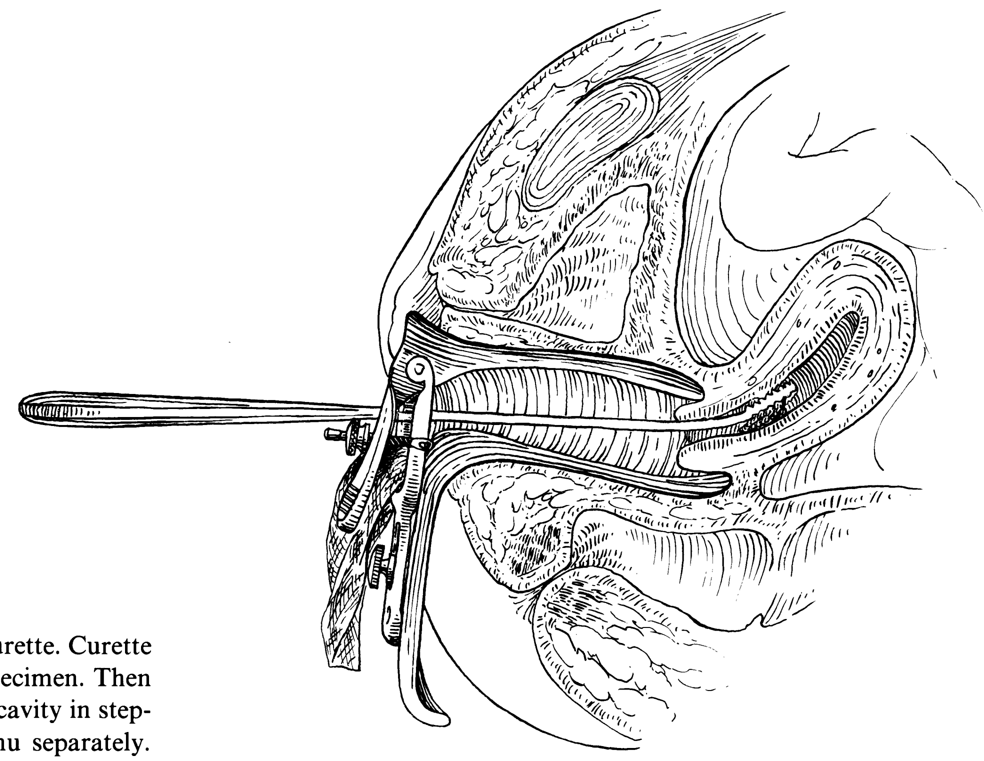


FIGURE 1-20. Insert a sharp curette. Curette the endocervix. Segregate the specimen. Then curette the endometrium of the cavity in stepwise fashion. Curette each cornu separately.

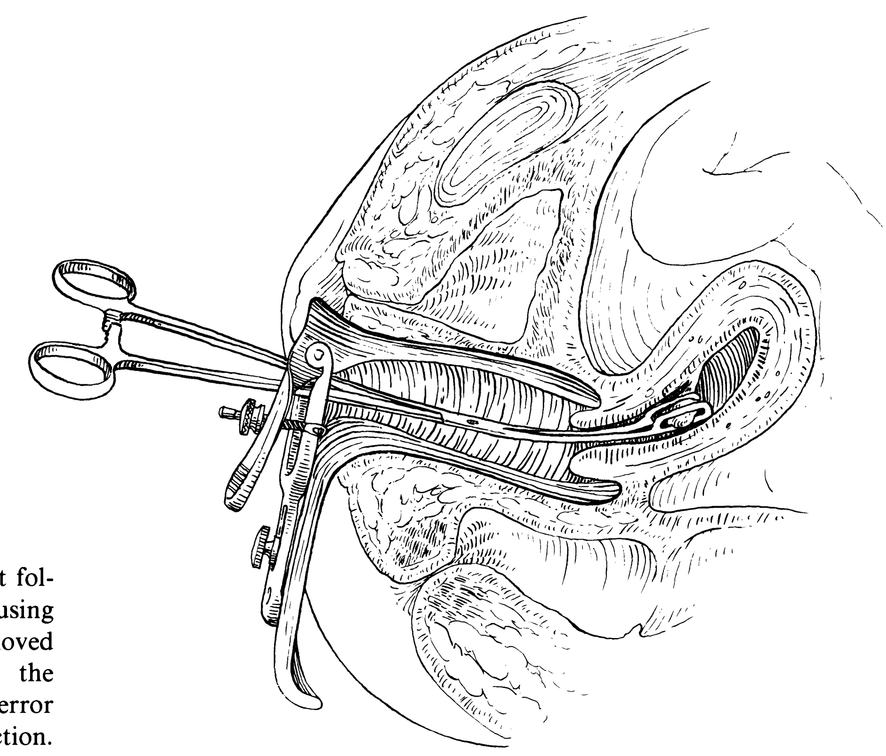


FIGURE 1-21. When polyps are present follow the curettage with their removal using Randal stone forceps. Most are easily removed by combining curettage and grasping the polyp with the forceps. Remember the error is not in their removal but in their detection.

If the curettage is done for an incomplete abortion, it is not usually necessary to dilate the cervix, but check the cavity with polyp forceps for retained tissue. For an oncologic evaluation, curette the endocervix with a small Heaney curette. Remember that patients who have had incomplete abortions should be typed and administered RhoGAM to prevent isoimmunization.

If uterine perforation is discovered, check it with a sound. Pass the sound through the margins of the suspected perforation. If the perforation is in the midline and manipulations of the uterus have been gently performed, further problems are uncommon.

If the uterine perforation is lateral, the possibilities of concealed hemorrhage exist. Introduction of the laparoscope will document the injury to adjacent viscera. If injury of the bladder, colon, small bowel, or other structures exists, immediate laparotomy is necessary.

Following uncomplicated D & C, the patient is dismissed to return to the office in 1 week for follow-up visit and review of the pathologic findings. Histologic diagnoses found on outpatient curettage are listed in Table 1-1.

Despite most clinicians' feelings, there is no evidence that conclusively documents a direct cause and effect relationship between a D & C and improvement of menstrual disorders. In a well-designed study, patients with complaints of menorrhagia had a reduction in the amount of blood lost the first month after a D & C. However, this reduction was temporary and by the second month the amount of blood lost by most patients was greater than their mean loss overall.[25]

TABLE 1-1. Histologic Diagnoses

Diagnosis	No. of Patients
Progestational	165
Proliferative	109
Hyperplasia	37
Atrophic or inactive	35
Carcinoma	10
Endometrial polyp	10
Endocervical polyp	7
Incomplete abortion (unrecognized)	7
Tuberculosis	1
Insufficient tissue	44

From Mengert WF and Slate WG.[38]

Note that most patients who do have curettages performed for menorrhagia have benign endometrial abnormalities. Patients who have a progestational endometrium will not need additional endocrine therapy. Treat patients who have hyperplastic endometrium of benign type or proliferative endometrium with 100 mg progesterone in oil.

If one postulates endometrial removal as the therapeutic effect of a D & C, Stock et al note most patients have less than 50% of the endometrium curetted.[46] This data further confirms the increased need for office endometrial biopsy for diagnosis and thoughtful endocrine manipulation of the endometrium to control menorrhagia due to nonmalignant endometrial abnormalities. Grimes has further documented the cost-effectiveness of endometrial biopsy as compared to D & C.[24]

Fine Needle Aspiration

Fine needle aspiration biopsy was described in the mid-1800s by Kun and was favored by Paget.[21] Only in the past decade has the technique gained acceptance among clinicians in the United States. Its success in Scandinavia has resulted in annual savings of 1.5 million dollars at the Karolinski Institute alone.[21] Increasingly, reports attesting to the accuracy of this simple, inexpensive procedure for cytologic diagnosis are appearing in the literature.

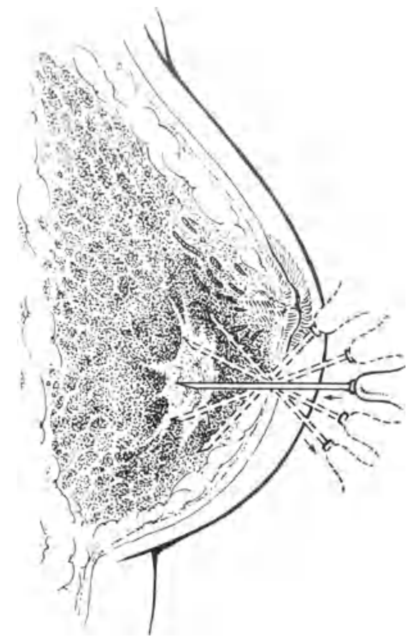


FIGURE 1-22. After placing the patient in a comfortable position, anesthetize the skin overlying the mass with 1% lidocaine (Xylocaine). Some operators omit local injection, as they feel the discomfort produced exceeds that produced by simple passage of the needle. Stabilize the mass with one hand while inserting a 22-gauge needle attached to a 20-cc syringe fitted with a syringe holder or vacuum handle with fitted needle. Maintain full negative pressure while advancing and withdrawing the needle through a 180° arc tangential to the chest wall. Terminate the procedure when a sample is observed at the needle-syringe junction. Release the vacuum and withdraw the needle. Immediately prepare and fix slides for cytologic study.

Breast masses are uniquely suited to evaluation by fine needle aspiration. The technique is described in Fig. 1-22. Shabot et al compared traditional modes of diagnosing malignancy and found clinical diagnosis correct in 85% of cases (2.5% false negative and 12.5% false positive), mammography diagnostic in 52.8% (31.5% false negative and 15.7% false positive), needle biopsy accurate in 78.9% (21.1% false negative and 0% false positive), and aspiration cytology diagnostic in 96.2% (3.8% false negative and 0% false positive).[44] Innes and Feldman have emphasized the accuracy of fine needle aspiration over Tru-Cut biopsies.[27] They point out that radical surgery (mastectomy) is routinely performed without prior surgical biopsy owing to the accuracy of the fine needle aspiration.

Gynecologists are going to be faced with an increasing number of patients who present with abnormal findings from hospital-based or free-standing breast diagnostic centers. Clinical and cytologic proficiencies are required to prevent or minimize falsely positive and falsely negative results. Kambouris suggests using the scheme presented in Fig. 1-23 for managing breast masses.[29] It combines the three major diagnostic modalities and provides guidance for management of categories of cytology other than malignant or benign. Current technology would indicate that x-ray mammography is the most accurate method of noninvasive breast diagnosis. Ultrasound is useful in determining if a mass seen is cystic or solid. The gynecologist should be familiar with the recommendations of the American Cancer Society on breast imaging as well as with the most current information in breast cancer management in order to advise patients appropriately. Such discussion is beyond the scope of this book but is the information that the female patient will want to discuss with her gynecologist.

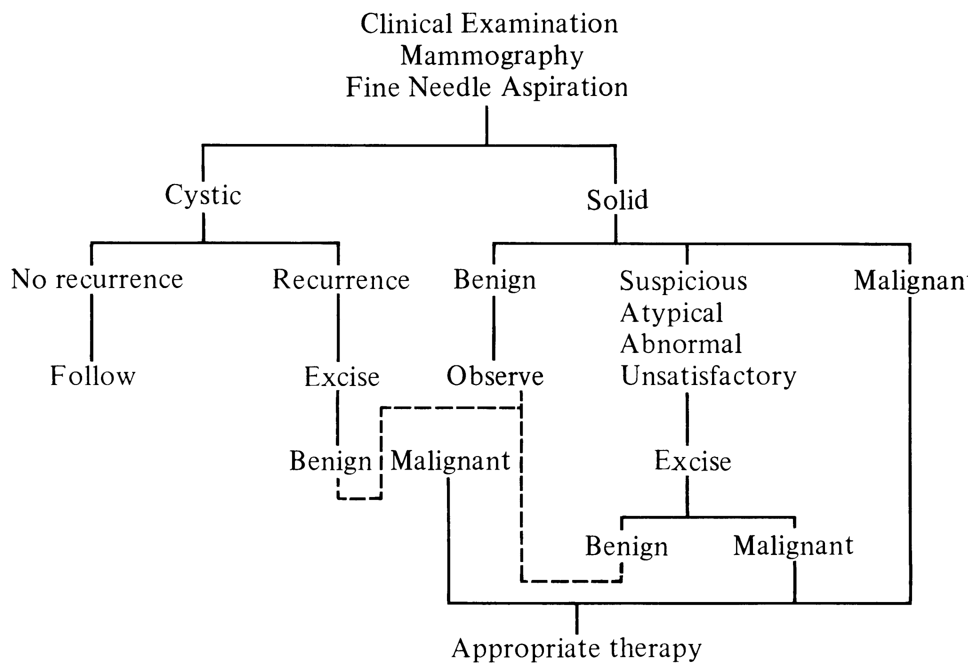


FIGURE 1-23. Schemata for detecting breast tumors using clinical examination, mammography, and fine needle aspiration. (Adapted from Kambouris.[29])

Fine needle aspiration of suspicious retroperitoneal lymph nodes and pelvic masses offers the clinician and patient an alternative diagnostic modality with minimal morbidity. Traditional approaches to tissue diagnosis have involved laparotomy with selected biopsy in patients in whom there is clinical suggestion of recurrent malignant disease. McDonald et al demonstrated a diagnostic accuracy of 74% when using fine needle aspiration to obtain cytologic specimens from retroperitoneal nodes in patients with lymphangiographic abnormalities.[37] No major complications were reported though bowel and pelvic vessels were traversed during the aspiration. A 22-gauge Chiba needle attached to 20-cc syringe is inserted through a sterile, anesthetized field. Fluoroscopic guidance is advised in patients with suspicious lymphangiograms. Upon entering the capsule of the lymph node, aspiration is accomplished and negative pressure is released before the needle is withdrawn. The specimen is ejected onto a glass slide and immediately fixed. In patients expected to receive no benefit from further surgery, a report of persistent or recurrent disease by fine needle aspiration precludes the morbidity associated with laparotomy and selected biopsy. Furthermore, extended therapy can be immediately instituted. If further therapy depends on biopsy-proven disease and the lymphangiogram is abnormal in the face of a negative cytologic study, surgical exploration is advised.[37]

Appendix: Standard Surgical Instruments

Ambulatory Surgery
- Gloves
- Drapes
- Light source
- 1% lidocaine (Xylocaine) with epinephrine
- 1% lidocaine jelly
- Aqueous benzalkonium (Zephiran)
- 3% acetic acid
- Povidone-iodine (Betadine) scrub
- Cotton pledgets
- Gauze squares
- Specimen containers
- Sutures, assorted sizes
- Schiller's solution
- Toluidine blue
- Ferrous subsulfate
- Silver nitrate

Vulvar Biopsy, Bartholin's Gland, Marsupialization, and Hymenal Surgery
- 3-mm disposable punch
- Adson-Brown thumb forceps
- Needle holder
- Suture scissors
- 2 Allis clamps
- Knife
- 3 Mosquito hemostats
- Vaginal dilator

Vaginal and Cervical Surgery
- Biopsy forceps
- Thumb forceps, long
- Needle holder, long

Colposcopy
- Spray bottle of 3% acetic acid
- Long procto-type applicators
- Sponges
- Small Q-tips
- Skin hooks
- Biopsy forceps
- Endocervical curette
- Speculum

Endometrial Biopsy
- Endometrial aspiration biopsy kit, 2 mm and 3 mm
- Uterine sound

Dilatation and Curettage
- Tenaculum
- Graduated uterine sounds
- Graduated uterine dilators
- Heaney curette
- Medium sharp curette
- Randal stone forceps
- Weighted speculum

References

1. Aaro LA, Jacobson LJ, Soule EH: Endocervical polyps. *Obstet Gynecol* 1963; 21:659–665.
2. Baggish MS: Carbon dioxide laser treatment for condylomata acuminata veneral infections. *Obstet Gynecol* 1980; 55:711–715.
3. Baggish MS: Management of cervical intraepithelial neoplasia by carbon dioxide laser. *Obstet Gynecol* 1982; 60:378–384.
4. Baggish MS, Dorsey JH: CO_2 laser for the treatment of vulvar carcinoma in situ. *Obstet Gynecol* 1981; 57:371–375.
5. Bibbo M, Reale FR, Reale JC, et al: Assessment of three sampling technics to detect endometrial cancer and its precursors. *Acta Cytol* 1979; 23:353–359.
6. Bowing HH, Fricke RE, Kennedy TJ: Radium therapy for carcinoma of Bartholin's glands. *Am J Roentgenol* 1949; 61:517–529.
7. Burk JR, Lehman HF, Wolf FS: Inadequacy of Papanicolaou smears in the detection of endometrial cancer. *N Engl J Med* 1974; 291:191–192.
8. Burke L: The use of the carbon dioxide laser in the therapy of cervical intraepithelial neoplasia. *Am J Obstet Gynecol* 1982; 144:337–340.
9. Calkins JW, Masterson BJ, Magrina JF, et al: Management of condylomata acuminata with the carbon dioxide laser. *Obstet Gynecol* 1982; 59:105–108.
10. Capen CV, Masterson BJ, Magrina JF, et al: Laser therapy of vaginal intraepithelial neoplasia. *Am J Obstet Gynecol* 1982; 142:973–976.
11. Centers for Disease Control: Condyloma acuminatum—United States, 1966–1981. *MMWR* 1983; 32:306–308.
12. Creasman WT, Hinshaw WM, Clarke-Pearson DL: Cryosurgery in the management of cervical intraepithelial neoplasia. *Obstet Gynecol* 1984; 63:145–149.
13. Creasman WT, Parker RT: Management of early cervical neoplasia. *Clin Obstet Gynecol* 1975; 18:233–245.
14. Creasman WT, Weed JC, Curry SL, et al: Efficacy of cryosurgical treatment of severe cervical intraepithelial neoplasia. *Obstet Gynecol* 1973; 41:501–505.
15. Creasman WT, Weed JC, Curry SL, et al: Efficacy of cryosurgical treatment of severe cervical intraepithelial neoplasia. *Obstet Gynecol* 1973; 41:501–506.
16. Daichman I, Mackles D: Diagnostic curettage—a 13-year study of 585 patients. *Am J Obstet Gynecol* 1966; 95:212–218.
17. Dexeus SJ, Carrera JM, Coupez F: *Colposcopy* (Austin, K.L., transl.). Philadelphia, Saunders, 1977.

18. DiSaia PH, Morrow CP, Townsend DE: Cancer of the corpus, in *Synopsis of Gynecologic Oncology.* New York, Wiley, 1975.
19. Einerth Y: Vacuum curettage by the Vabra® method: A simple procedure for endometrial diagnosis. *Acta Obstet Gynecol Scand* 1982; 61:373–376.
20. Ferenczy A, Shore M, Guralnick M, et al: The kevorkian curette: An appraisal of its effectiveness in endometrial evaluation. *Obstet Gynecol* 1979; 54:262–267.
21. Frable WJ: Fine-needle aspiration biopsy: A review. *Hum Pathol* 1983; 14:9–28.
22. Goldman L, Rockwell RJ Jr: *Lasers in medicine.* New York, Gordon and Breach Science Publishers, 1971.
23. Goldwrath MH, Sherman AI: Office hysteroscopy and suction curettage: Can we eliminate the hospital diagnostic dilatation and curettage? *Am J Obstet Gynecol* 1985; 152:220–229.
24. Grimes DA: Diagnostic dilation and curettage: A reappraisal. *Am J Obstet Gynecol* 1982; 142:1–6.
25. Haynes PJ, Hodgson H, Anderson ABM, et al: Measurement of menstrual blood loss in patients complaining of menorrhagia. *Br J Obstet Gynaecol* 1977; 84:763–768.
26. Herbst AL, Cole P, Colton T, et al: Age-incidence and risk of diethylstilbestrol-related clear cell adenocarcinoma of the vagina and cervix. *Am J Obstet Gynecol* 1977; 128:43–50.
27. Innes DJ Jr, Feldman PS: Comparison of diagnostic results obtained by fine needle aspiration cytology and tru-cut or open biopies. *Acta Cytol* 1983; 27:350–354.
28. Jonas HS: Early diagnosis of endometrial cancer, in Masterson, BJ (ed.): *Proceedings of Symposium on New Developments in Gynecologic Cancer.* Lawrence, Kansas, University of Kansas Printing Service, 1978.
29. Kambouris AA: The role of fine needle aspiration cytology in the management of solid breast tumors. *Am Surg* 1983; 49:310–313.
30. Kelly JA: Curettage without anesthesia on the office table. *Am J Obstet Gynecol* 1925; 9:78–80.
31. Kennedy CR: After office hours. *Obstet Gynecol* 1961; 17:128–134.
32. Larsson G, Alm P, Grundsell H: Laser conization versus cold knife conization. *Surg Gynecol Obstet* 1982; 154:59–61.
33. Lupulescu A, Mehregan AH, Rahbari H, et al: Venereal warts vs Bowens disease: A histologic and ultrastructure of five cases. *JAMA* 1977; 237:2520–2522.
34. Maisel FJ, Nelson HB, Ott RE, et al: Papanicolaou smear, biopsy, and conization of cervix. *Am J Obstet Gynecol* 1963; 86:931–936.
35. Masterson BJ, Krantz KE, Calkins JW, et al: The carbon dioxide laser in cervical intraepithelial neoplasia: A five-year experience in treating 230 patients. *Am J Obstet Gynecol* 1981; 139:565–567.
36. McBurney EI: Carbon dioxide laser treatment of dermatologic lesion. *South Med J* 1978; 71:795–797.
37. McDonald TW, Morley GW, Choo YC, et al: Fine needle aspiration of para-aortic and pelvic lymph nodes showing lymphangiographic abnormalities. *Obstet Gynecol* 1983; 61:383–388.
38. Mengert WF, Slate WG: Diagnostic dilatation and curettage as an outpatient procedure. *Am J Obstet Gynecol* 1960; 79:727–731.
39. Moher LM, Maurer SA: Podophyllin toxicity: Case report and literature review. *J Fam Pract* 1979; 9:237–240.
40. Ostergard DR: Cryosurgical treatment of cervical intraepithelial neoplasia. *Obstet Gynecol* 1980; 56:231–233.
41. Pincus H, Lupulescu A, Mehregan AH, et al: Venereal disease vs Bowens disease. *JAMA* 1977; 238:2496.
42. Rajala BW, Boling RO, Capen CV, et al: *Evaluation of the Efficacy of the Masterson Aspirator for Endometrial Biopsy.* Presented at Armed Forces District of ACOG, Atlanta, GA. October 8-11, 1984.

43. Rutledge F: Cancer of the vagina. *Am J Obstet Gynecol* 1967; 97:635–649.
44. Shabot MM, Goldberg IM, Schick P, et al: Aspiration cytology is superior to Tru-Cut® needle biopsy in establishing the diagnosis of clinically suspicious breast masses. *Ann Surg* 1982; 196:122–126.
45. Sowa DE, Masterson BJ, Nealon N, et al: Effects of thermal knives on wound healing. *Obstet Gynecol* 1985; 66:436–439.
46. Stock RJ, Kanbour A: Prehysterectomy curettage. *Obstet Gynecol* 1975; 45:537–541.
47. Townsend DE: Cryosurgery. *Obstet Gynecol Annu* 1975; 4:331–345.
48. Townsend DE, Levine RU, Crum CP, et al: Treatment of vaginal carcinoma in situ with the carbon dioxide laser. *Am J Obstet Gynecol* 1982; 143:565–568.
49. Townsend DE, Levine RU, Richart RM, et al: Management of vulvar intraepithelial neoplasia by carbon dioxide laser. *Obstet Gynecol* 1982; 60:49–52.
50. Urcuyo R, Rome RM, Nelson JH: Some observations on the value of endocervical curettage performed as an integral part of colposcopic examination of patients with abnormal cervical cytology. *Am J Obstet Gynecol* 1977; 128:787–792.
51. Winer WK: Laser treatment of cervical neoplasia. *Am J Nurs* 1982; 82:1384–1387.

Selected Bibliography

Blaustein A (ed.): *Pathology of the Female Genital Tract.* 2nd ed. New York, Springer-Verlag, 1982.

2 Laparoscopy

Walter M. Wolfe

Laparoscopy ranks as one of the most important technological advances in gynecology of the 20th century. Since its introduction to this country in the late 1960s, laparoscopy has become one of the most common gynecologic surgical procedures. In addition, the technology of laparoscopy has been adapted to other endoscopic procedures such as cystourethroscopy and hysteroscopy, leading to a revolution in gynecologic diagnosis and treatment. Diagnostic and operative laparoscopy can be performed in an ambulatory setting when appropriate and at almost any point in a woman's life cycle, except perhaps advanced pregnancy or diffuse inflammatory or malignant processes. Laparoscopy may be done under general or local anesthetic, depending on the cooperation and desire of the patient and the skill of the operating surgeon.

Indications

The burgeoning popularity of laparoscopy has led to a rapid expansion of indications, both diagnostic and therapeutic.[6,8] The following lists can only be considered incomplete, as both categories are expanding even at this writing.

Diagnostic:

1. Evaluation of the infertile patient[31]
2. Evaluation of pelvic pain of uncertain origin
3. Suspected ectopic pregnancy
4. Evaluation of pelvic inflammatory disease
5. Suspected uterine injury
6. Localization and/or removal of foreign objects (such as the lost intrauterine device)
7. Evaluation of small pelvic tumor
8. Second-look after therapy for certain pelvic malignancies (including aspiration of ascitic fluid)[37,49]
9. Residual ovary syndrome.

Therapeutic

1. Female tubal sterilization
2. Salpingo-ovarian adhesiolysis
3. Salpingostomy

4. Puncture and biopsy of ovarian cyst
5. Treatment of certain stages of endometriosis
6. Treatment of early unruptured ectopic pregnancy
7. Treatment of selected cases of pelvic inflammatory disease with abscess formation[19]
8. Removal of foreign objects from peritoneal cavity

Contraindications

Absolute

Contraindications to laparoscopy also are in a continuous state of flux. Currently, the only absolute contraindications are those conditions that would mitigate against the production of pneumoperitoneum and/or the insertion of a trocar into the abdominal cavity. For example, cardiovascular-pulmonary conditions in which a pneumoperitoneum could compromise such preexisting conditions as heart failure or severe diminution of pulmonary function. A trocar should not be inserted in the presence of local abdominal conditions such as advanced pregnancy, diffuse peritonitis, or history of conditions known to produce diffuse adhesions such as intra-abdominal chemotherapy and/or radiation.

Relative

Previous abdominal surgery (particularly adnexal surgery), obesity, previous cesarean section, history of pelvic inflammatory disease (acute or chronic), hematoperitoneum, and experience of the surgeon have been traditionally listed as relative contraindications to laparoscopy.[8]

Worldwide laparoscopic experience and on-going improvement in instrumentation have substantially altered the risk of physical and anatomic contraindications. Experience with alternative methods to achieve safe pneumoperitoneum and trocar insertion have nullified many real and theoretical concerns.

Currently, the training and experience of the surgeon and the availability of necessary instrumentation are the most relevant mediators of the appropriateness of a laparoscopic procedure in the absence of an absolute contraindication. There are various procedures and instrument choices available to the surgeon for safe and successful laparoscopy (Table 2-1).

TABLE 2-1. Laparoscopic Alternatives

Safe, successful laparoscopy depends on the following:

I. Developing and maintaining adequate pneumoperitoneum.
   A. Pneumoperitoneum developed *prior to* insertion
      1. Verres needle transabdominal—firm abdominal wall, average adipose tissue
      2. Verres needle culdocentesis—extremely obese patient
   B. Pneumoperitoneum developed *after* insertion
      1. Direct insertion—sterilization
      2. Open laparoscopy—abdominal scarring, previous surgery

II. Good visualization and ability to manipulate pelvic structures.
   A. Single-puncture procedure—sterilization
   B. Double-(multiple) puncture wounds—lysis of adhesions, ovum retrieval endoscopic surgery
   C. Uterine manipulators
      1. Semm suction cannula
      2. Cohen acorn cannula with tenaculum
      3. Noncannulated combination instruments—Hulka, Sargis
      4. Cannulated combination instruments—Behrman, Quinonas

Instruments

Laparoscopy is the result of the confluent development of fiber optic light transmission, gas insufflation and stabilization through "demand" regulators, and the lessons learned from the earlier techniques of peritoneoscopy and culdoscopy. Current laparoscopic techniques use a variety of optical systems consisting of high-grade optical telescopes with incorporated fiberoptic bundles and "cold" light transmission (fiberoptic) cables. By establishing and maintaining adequate pneumoperitoneum, intra-abdominal structures can then be isolated, observed, and manipulated. It is impossible to single out any particular laparoscopic system or group of instruments that can serve all the varied needs of gynecologists. As optical systems improve, smaller laparoscopes will produce sharper and clearer images.

The market today affords a wide variety of laparoscopes of various sizes and with varying aperture angles and diameters. There are, however, basically two types of laparoscopes. The first is the straight, diagnostic, double-puncture or viewing laparoscope that has a telescopic lense system with a light bundle. There is no instrument channel and this telescope must be used with a second-puncture capability if it is to be used for operative techniques. The second general classification of laparoscopes is the operating or single-puncture laparoscope that contains an operating channel in diameters of either 3, 5, 7, or more recently 9 mm. Remember, all operating laparoscopes have an offset objective or eyepiece. This eyepiece is offset by one or two right-angle prisms that allow right-angle and parallel viewing or a 45° single prism. Operating laparoscopes also impose some loss of visualization because there is some reduction in the number of light-conducting bundles and/or the size of the telescopic lens system. At least 10° can be lost through the channel so that 170° vision is obtained. Although orientation is uniform with this instrument, the image is smaller and the fixed position of the instrument in relation to the field visualized may be restricting.

The straight or diagnostic laparoscope has a larger and brighter visual field (0°–180°) and is therefore more useful in diagnostic work, particularly when photographic or video documentation is desired. However, the operating or single-puncture laparoscope has the advantage of performing most diagnostic and some surgical procedures (especially sterilization) through a single puncture.

Many operators prefer the multiple-puncture technique. With this technique a viewing (double-puncture) telescope is inserted for observation and a second (or more) trocar is inserted to manipulate the pelvic structures. Although this technique is more complicated and requires the purchase of extra instruments, it is more flexible and more readily adapted to photo or video documentation. The author uses a 10-mm viewing (double-puncture) telescope that will allow second-puncture instruments if desired or indicated, and a single-puncture 10-mm telescope with 7-mm channel that will accommodate most of the instruments now available for female sterilization and other manipulations. The initial observation of the pelvis is done with a straight (double-puncture) telescope, and any photographic or video documentation can be done at this time with the proper light source. If only sterilization is indicated, this may be accomplished through substitution of a single-puncture instrument or, if required, a second puncture can be made and the surgical procedure done as a multiple-puncture technique.

A second category of laparoscopic instruments are those used for surgery, especially sterilization. Several instruments are available that are adequate for bipolar cautery (either double-puncture or single-puncture operations).

It is imperative that cautery sterilization is done only with bipolar instruments. Unipolar cautery has been the source of intra-abdominal burns and accidents resulting in patient deaths. These instruments have been disapproved by the Food and Drug Administration, American College of Obstetrics and Gynecology, and American Association of Gynecologic Laparoscopists. However, all other cautery instruments, such as scissors, hooks, and probes, are only available in unipolar design, although some bipolar spot cautery instruments are being introduced. The unipolar instruments should be used with great care and require a safe-patient connecting pad and special circuitry to protect the patient. The choice of electrical cautery generators should be made with these facts in mind as well as the surgeon's expectations for laparoscopy. If laparoscopy will be used only for sterilization, then a bipolar cautery generator is all that is necessary. However, if laparoscopy will be used for other surgical procedures requiring unipolar cautery, then a generator that can be converted easily from bipolar to unipolar should be chosen.

Another important decision is the selection of light source, as most light sources can be quite expensive. Again, the surgeon's expectations about documenting surgery with photography or video will enter into the selection of light sources. Simple diagnostic light sources usually consist of an incandescent element of 100- to 300-W capacity, which is sufficient for diagnostic and operative purposes without photographic documentation. Photographic light sources that incorporate special bulbs producing strong monochromatic light for photography or video and special strobe or flash sources for still photography are available.[9] Photographic or video documentation of an operative or diagnostic procedure is useful for patient education or medical/legal purposes.

In order to be cost effective, the decision about laparoscopic instrumentation can only be made knowing the type of laparoscopic procedure expected. Open-ended decisions about instruments may require a greater initial investment, but will prevent duplication of basic requirements should the operator choose to increase the scope of laparoscopic surgery.

Surgical Anatomy

Entry through the abdominal wall is best accomplished through the umbilical area, preferably the lower border of the umbilicus. The umbilicus is a scar that welds the skin to the peritoneum with some intervening fascia and scar tissue (Fig. 2-1). The umbilicus contains no intervening fat deposits and no large blood vessels. It effectively anchors skin, fascia and peritoneum into one mass, even in the most obese patients. Therefore, the umbilicus is a logical point of entry for needles to create a pneumoperitoneum, and for the sleeve and trocar of the laparoscope itself.

Avoiding injury to underlying viscera is the most important principle of the laparoscopic procedure. For the most part, the underlying viscera, unless fixed by adhesions due to previous surgery, inflammatory disease, or radiation, are freely mobile and will push ahead of instruments inserted through the abdominal wall. It is possible to fix a loop of bowel between the trocar point and the posterior abdominal wall and thereby injure the bowel. The most dangerous underlying viscera are those that are retroperitoneal or fixed. These include, of course, the large vessels such as the aorta and vena cava. Maximum pneumoperitoneum and/or manipulations of the anterior abdominal wall cannot prevent injury to these vessels by the improperly or carelessly inserted instrument. The laparoscopist must purposefully and carefully direct all instrument insertions toward the pelvic cavity. Keep the patient in the horizontal supine position until insertion of all needles and trocars has been completed

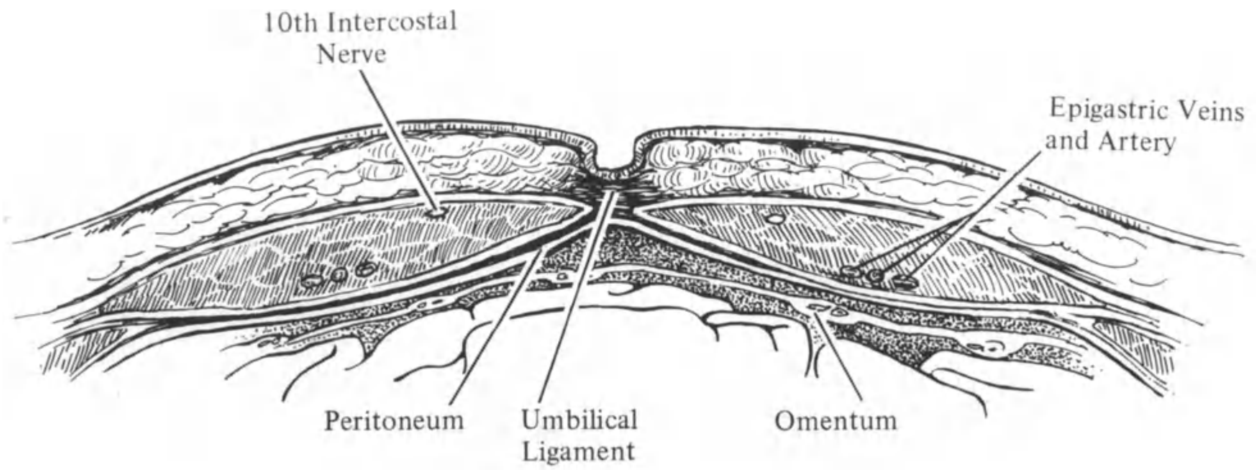


FIGURE 2-1. The umbilicus is the anatomic approach to the peritoneal cavity. It is a firm block of scar tissue extending from the skin to the peritoneum and incorporates all fascial layers with no intervening fat, blood vessels, muscles or separate fascial planes. It is fixed inferiorly by the obliterated umbilical arteries and the urachus. Penetration of the abdominal wall with needles or trocars should be all or partly through this area.

and the laparoscope is in place. Placing the patient in a Trendelenburg position prior to insertion of the needles or trocars will alter the position of the sacral promontory in relation to the surgeon and make penetration to the posterior abdominal wall likely, with possible injury to retroperitoneal structures.

The innervation of and blood supply to the abdominal wall is of importance if the operator intends to use a local anesthetic for laparoscopy (Fig. 2-2). The periumbilical area is innervated by two sets of cutaneous nerves of the thoracic nerves 10 through 12. These are the lateral cutaneous nerves and the anterior perforating cutaneous nerves. The lateral cutaneous nerves sweep medially from the flanks and supply some cutaneous innervation to the periumbilical area. The anterior cutaneous branches of the thoracic nerves perforate through the rectus fascia below the umbilicus nearer the midline. The blood supply to the anterior abdominal walls is provided chiefly through the superior and inferior epigastric arteries.

Anesthetics for Laparoscopy

European laparoscopists have used local anesthetics since the 1940's.[8] In the United States, however, general anesthesia with endotracheal intubation has been preferred.[36] Recent data indicate that almost half of the serious complications resulting from laparoscopic sterilization are related to general anesthetics.[34] Deaths due to anesthetic, respiratory, and cardiovascular accidents are more numerous in the literature than deaths due specifically to errors in technique. Therefore, the author prefers local anesthetics for simple diagnostic procedures and sterilization provided the patient has been properly prepared and selected[1,26,33,51] (Fig. 2-3).

Careful selection of patients is one of the prerequisites for the successful use of local anesthetics. Patients with psychological and emotional problems that would make the use of local anesthetics inappropriate can usually be detected during the first interview. Careful discussion with the patient about her experience with previous minor surgery—such as dilatation and curettage (D&C), abortion, or breast biopsy—can be used to place the laparoscopic

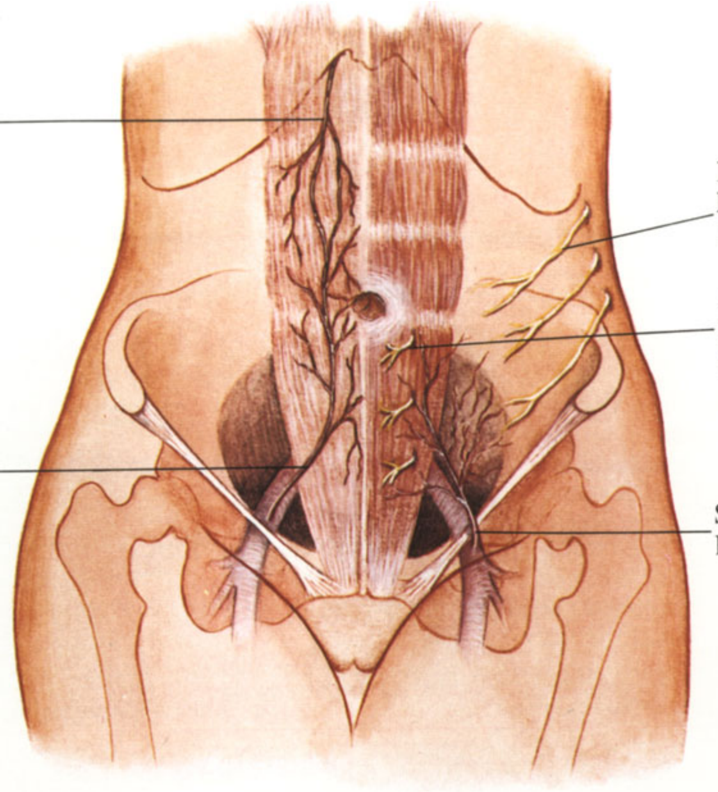


FIGURE 2-2. Important innervation (sensory) of the periumbilical area illustrates the need for the field block in local anesthesia. The arterial blood supply of the rectus muscles poses a hazard when making needle or trocar punctures lateral to the midline.

procedure in the proper perspective. Patients' experiences with dental procedures and anesthesia/analgesia during labor and childbirth are helpful indicators. Our patients are carefully prepared using audiovisual material and individual and group discussion to develop the concept that the anesthetic policies are flexible and that the goal is to avoid unnecessary risk and discomfort.

Preoperative and intra-operative medications are used to make the procedure as comfortable as possible for the patient. If, at any time, these methods fail to allow the patient to tolerate the procedure, general anesthesia, and required endotracheal intubation, can be instituted if necessary.

In addition to careful patient selection and appropriate counseling, the operating room personnel must be trained to include the patient as part of the operating team and to move slowly during operating preparations. Inform the patient of each step and receive her tacit permission to proceed. Avoid loud noise or conversation, which make the patient feel isolated.

Normal preoperative medication is a loading dose of one of the prostaglandin synthetase inhibitors, such as sodium naproxen or meclofenamate sodium orally, 30 minutes prior to the procedure. The patient also receives 10 mg of diazepam, orally.

With either local or general anesthetics, patients who have been premedicated with an oxycyclase inhibitor to prevent prostaglandin production on injury to the uterus and tubes seem to have a smoother intraoperative and postoperative course. After preparation of the abdomen, perineum, and vagina, the patient is catheterized, the bladder emptied, and careful pelvic examination

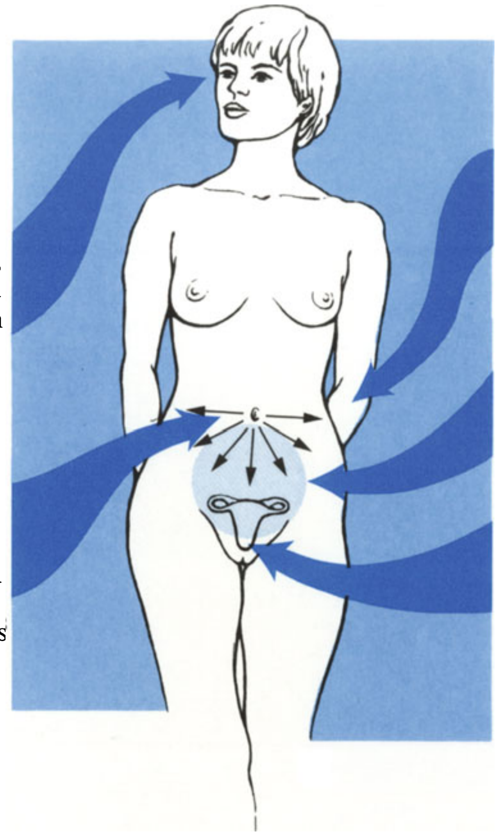


FIGURE 2-3. A summary of the basic steps for obtaining maximum patient relief from pain during laparoscopy under local anesthesia.

performed. Twenty milliliters of 1% lidocaine may be injected through a hollow cannula into the uterine cavity and out through the fallopian tubes. This allows manipulation of the pelvic viscera without undue discomfort.

The anterior abdominal wall is anesthetized by injecting an intradermal wheal of 1% lidocaine at the lower border of the umbilicus, and expanding about 1 cm on each side of the umbilicus. A stab wound is made in the skin and a 3-inch spinal needle is used to perform a multiple puncture field block to block the lateral cutaneous and anterior cutaneous nerves of the anterior abdominal wall[15] (Fig. 2-4). The field block will allow manipulation of the anterior abdominal wall during direct insertion without unusual discomfort. In addition, the spinal needle is used to inject 1% lidocaine down through the predicted tract of the trocar and sleeve, through the fascia to attempt to form a wheal between the fascia and peritoneum (Fig. 2-5). If pneumoperitoneum has been established through the cul-de-sac, the needle also can be used to test the presence of pneumoperitoneum, since gas inside the peritoneal cavity bubbles back through the syringe easily.

The incision is then enlarged to allow the insertion of the trocar and sleeve, which are pushed into the peritoneal cavity in the direction of the symphysis pubis at an angle of not less than 45° to the horizontal. The patient's voluntary muscle tension will avoid too deep penetration of the Verres needle or trocar. Once the sleeve is in place, a single-puncture telescope is passed, allowing the passage of a long aspirating needle through which 0.5% bupivacaine is dribbled onto the serosal surface of the fallopian tubes approximately 10 cc

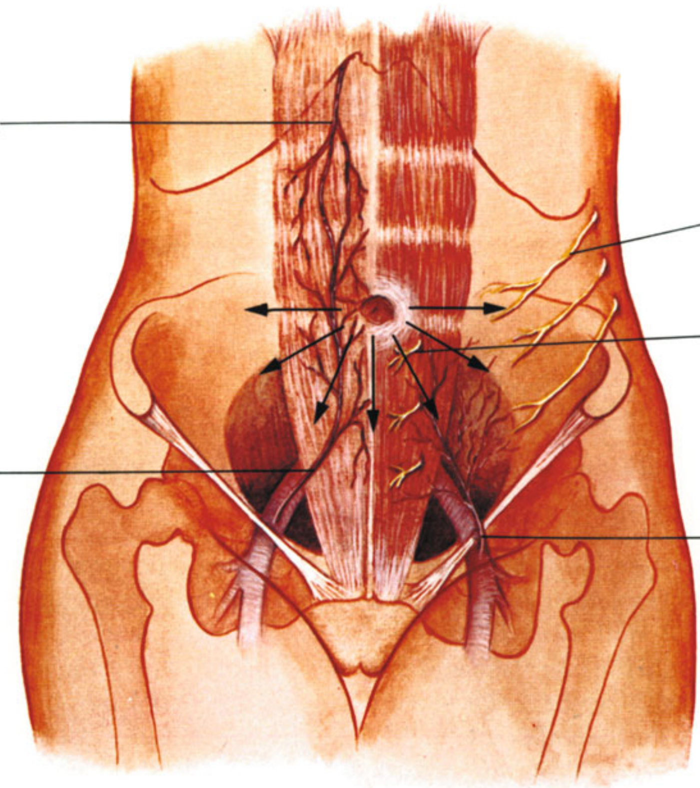


FIGURE 2-4. The periumbilical radial field block attempts to block the sensory fibers of the tenth through the twelfth intercostal nerves.

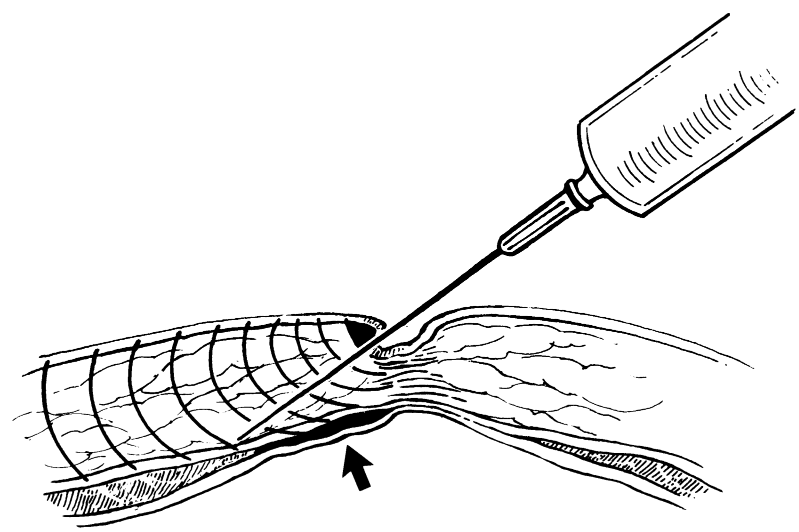


FIGURE 2-5. Note the dense local infiltration in the area through which the trocar will be inserted. A wheal between the peritoneum and the overlying fascia can be obtained by inserting the needle through the peritoneum and then injecting while withdrawing the needle. This avoids peritoneal pain when the trocar penetrates the peritoneum.

on each side. This medication is necessary for patient comfort during manipulation of the fallopian tube or other structures.

Although the total amount of lidocaine or other anesthetic may exceed recommended dosages, studies have shown that blood levels do not approach the convulsive levels.[44] When lidocaine is given by these routes, intravenous administration is virtually impossible and metabolic degradation begins in the tissue. Likewise, absorption from serosal surface does not substantially increase blood levels.

In the author's service, anesthesia is usually monitored by a nurse anesthetist, with an anesthesiologist on call. With the proper preparation and explanation, patients have been able to tolerate the procedure as well as frequent blood drawings for research projects and the video documentation of the surgery. Many patients wish to observe the operation and take great interest in the procedure. Such patient participation is encouraged. If the patient becomes restless or uncooperative owing to insufficient pain relief, then general anesthetics with endotracheal intubation can be quickly substituted. Good and adequate anesthesia can be obtained through conduction anesthesia, either epidural or spinal if appropriate.[2,5]

Laparoscopic Technique

In laparoscopy the visualization of the abdominal contents depends on the development and maintenance of a pneumoperitoneum which lifts the abdominal wall away from the underlying viscera and separates the pelvic organs from the omentum and intestine. The pneumoperitoneum also allows the pelvic organs to be moved for diagnostic or surgical purposes.

Position the patient in a modified lithotomy position. Legs are separated and supported by knee crutches or obstetrical-type leg supports. The knees and thighs should not be flexed on the abdomen any more than is absolutely necessary. The operator must stand at the side of the patient and must be able to reach down to the perineum to manipulate the uterus during the laparoscopic procedure. Raising the knees and thighs in an exaggerated lithotomy position does nothing to facilitate the procedure of laparoscopy. The patient should be in a level horizontal position until all instruments, including the laparoscope, are in position (Fig. 2-6). The Trendelenburg position should not be assumed before inserting the needle or trocar since this will raise the sacral promintory in relation to the operator and may cause this structure and its vascular (great vessel) relationship to be more vulnerable to injury (Fig. 2-7).

Prepare the abdomen, perineum, and vagina with a soap and scrub solution of povidone-iodine preparation.

Carefully catheterize the patient because an empty bladder is essential for visualizing the pelvic structures. It is not necessary to leave a catheter in place.

Carefully examine the pelvis to determine the size, shape, and position of the uterus. Look for any evidence of early pregnancy that may not have been diagnosed. If early pregnancy is suspected, the procedure may be postponed until the diagnosis can be verified or care taken not to insert instruments into the uterine cavity.

Carefully examine the adnexa to rule out any undiagnosed adnexal disease. If the possibility of adnexal infection exists, the procedure should be either postponed or the patient given covering antibiotics prophylactically during the procedure.

The position of the uterus is most important since undiagnosed posterior displacement of the uterus can result in injury to the uterus during the procedure. Perform a speculum examination of the cervix to rule out an infected cervix or, in some cases, a tightly stenotic cervix which may require some dilation before a uterine manipulator or elevator can be attached. Drape the patient with a lithotomy sheet through which an opening is cut over the umbilicus for access to the abdominal wall.

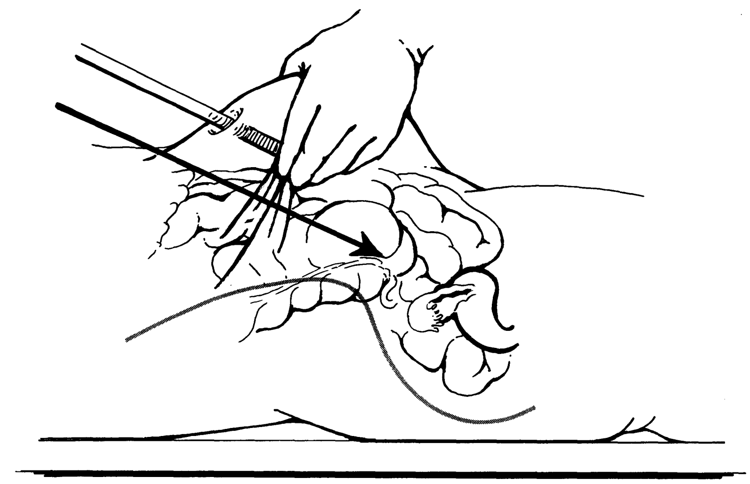


FIGURE 2-6. Note the relative safety with the patient in a flat position.

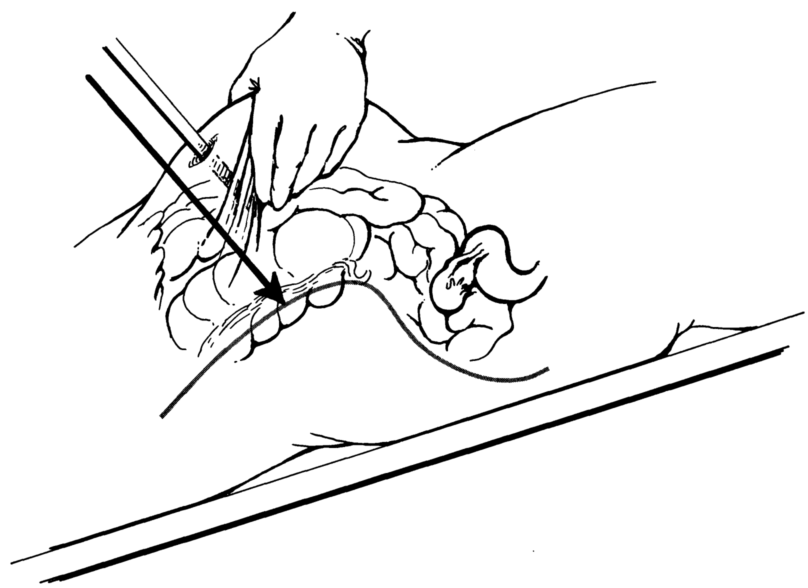


FIGURE 2-7. Note the increased hazard of inserting the trocar with the patient in a steep Trendelenberg position. Tilting the patient causes the sacral promontory to be in a more accessible position in relation to the operator's thrust. This increases the possibility of injury to retroperitoneal structures lying in this area in particular the aorta, the vena cava, and the common iliac vessels.

Establishing a Pneumoperitoneum

Insertion of the trocar and sleeve is the most anxiety-charged part of an otherwise simple and safe procedure. The abdominal wall is penetrated with a large, sharp instrument without visual contact with the underlying viscera. Both the neophyte and the experienced operator must trust their knowledge of the anatomy, the quality and condition of the equipment, and the control of the coordinated thrust of more than average force. There is really no other surgical maneuver quite like this.

Direct insertion of the trocar and sleeve has been shown to be a safe and efficient method of insertion in the majority of patients undergoing laparoscopy.[10,12,26] This method saves time and avoids the risk involved with use of penetrating insufflation needles. Direct insertion is also useful when local anesthesia presents the need for a quick procedure.

Direct insertion of the trocar and sleeve can be carried out under either general or local anesthesia, provided the anterior abdominal wall is reasonably

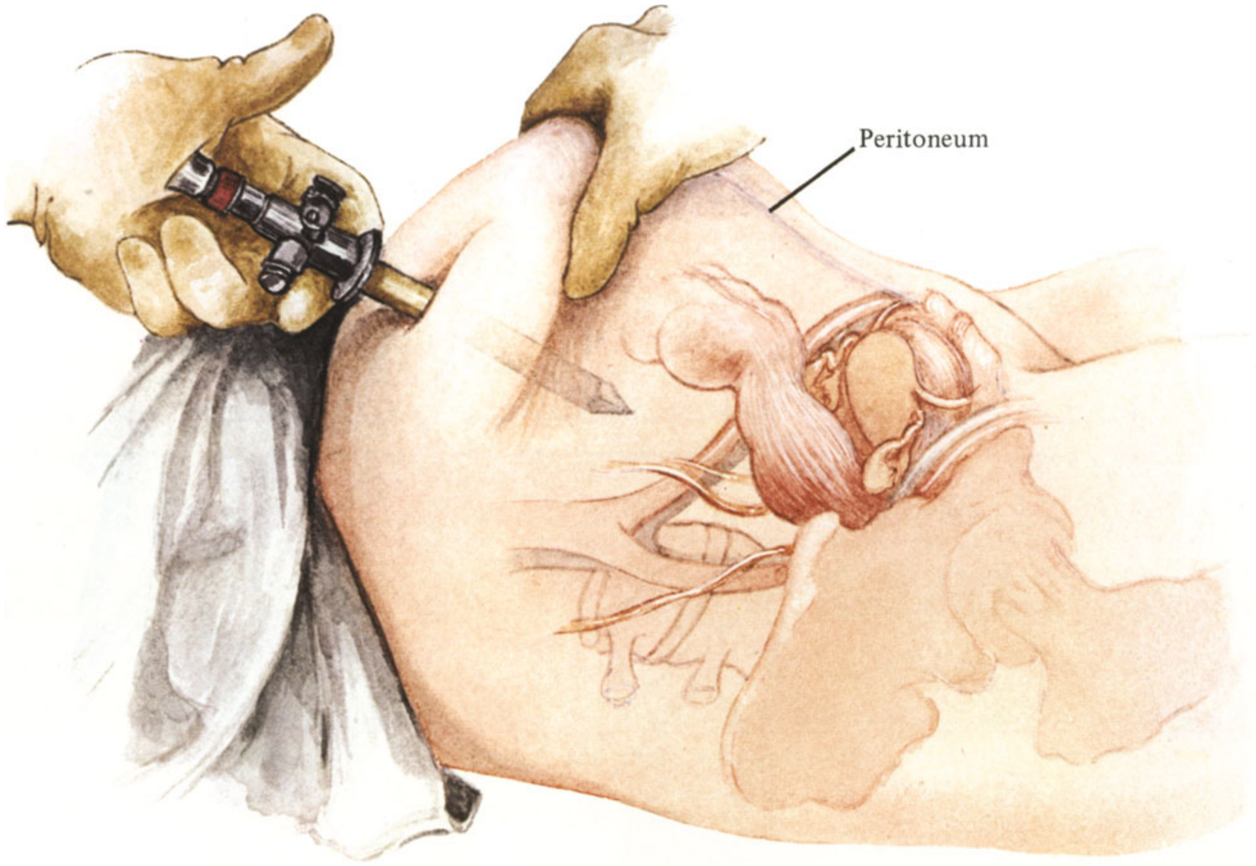


FIGURE 2-8. Direct insertion of the trocar prior to developing a pneumoperitoneum requires strong elevation of the relaxed abdominal wall to avoid intraperitoneal structures.

thin and the patient is either relaxed by general anesthetics or can relax her muscles enough to allow tenting up of the anterior abdominal wall. Obese patients whose skin cannot be grasped easily in the fingers of one hand, patients whose abdominal wall is tight, or patients with an abdominal incision would usually preclude direct insertion of the trocar and sleeve.

The trocar and sleeve are held in the dominant hand of the surgeon. The anterior abdominal wall is picked up at a point between the symphysis pubis and the umbilicus and tented upward sharply so that the skin between the umbilicus and tenting hand is as nearly vertical as possible. An incision is made in the lower border of the umbilicus to accommodate the size of the trocar and sleeve to be used, large enough that the skin will not bind on the sleeve. The trocar must be sharp for proper insertion. The trocar is inserted through the incision in a short stabbing or twisting motion in the direction of the symphysis pubis. The plane of insertion is frequently well above the normal plane of the relaxed abdominal wall (Fig. 2-8). When the trocar pierces the peritoneum, the sleeve can be advanced over the trocar and the trocar removed. Peritoneal penetration can be verified by opening the trumpet valve or flap valve of the sleeve and moving the anterior abdominal wall up and down. Air will be heard rushing in and out of the sleeve. The patient may then be placed in the Trendelenberg position and 1 to 1.5 L room air allowed to enter the peritoneal cavity.[26] At this point the telescope can be inserted and the peritoneal contents viewed. Occasionally (3% according to Copeland

FIGURE 2-9. Some operators prefer to elevate the lower abdominal wall to create a potential space for the placement of the insufflating needle. The needle should be inserted unattached and attached to the gas machine after insertion has been completed. The operator's fingers hold the hub of the needle, allowing the springloaded stylet to retract freely according to the density of the tissue. The angle of the needle should be not less than 45° from the vertical aimed toward the center of the pelvic inlet. *Inset:* The operator's fingers spread the lower umbilical fold so that the knife blade slides cleanly through the skin only. Some operators prefer to immobilize the lower umbilical fold between two iris clamps. The incision may be made vertically if preferred.

et al[10]) the sleeve will penetrate the omental sac and the abdominal contents will be viewed as through a membrane.[10] In these cases the sleeve can be withdrawn slightly and held perpendicularly as the abdominal wall is lifted. The omentum will fall away allowing clear vision of the visceral contents. Although direct insertion is viewed with some concern in this country, this method has been used in thousands of cases in India.[26] It has been reported adequately in the literature and Copeland et al have carefully documented 2,000 cases of direct insertion without unusual complications.[10] Since a large number of laparoscopies in this country are done for sterilization in otherwise healthy, normal, parous women, direct insertion is possible in the majority of the cases.

In individuals where obesity or muscle tone prevents easy tenting of the anterior abdominal wall, pneumoperitoneum is established initially by the insertion of either a Verres needle or a Touhey needle through the lower border of the umbilicus into the peritoneal cavity (Fig. 2-9). Gas pressure between 10 and 20 mm mercury usually indicates normal insertion.

In patients with extreme obesity, it is likely that in 50% of the cases extraperitoneal insufflation will occur. Therefore, in these patients the cul-de-sac is an excellent port for the insertion of the pneumoperitoneum needle[8] (Fig. 2-10). The cervix may be grasped with the usual cervical stabilization instrument

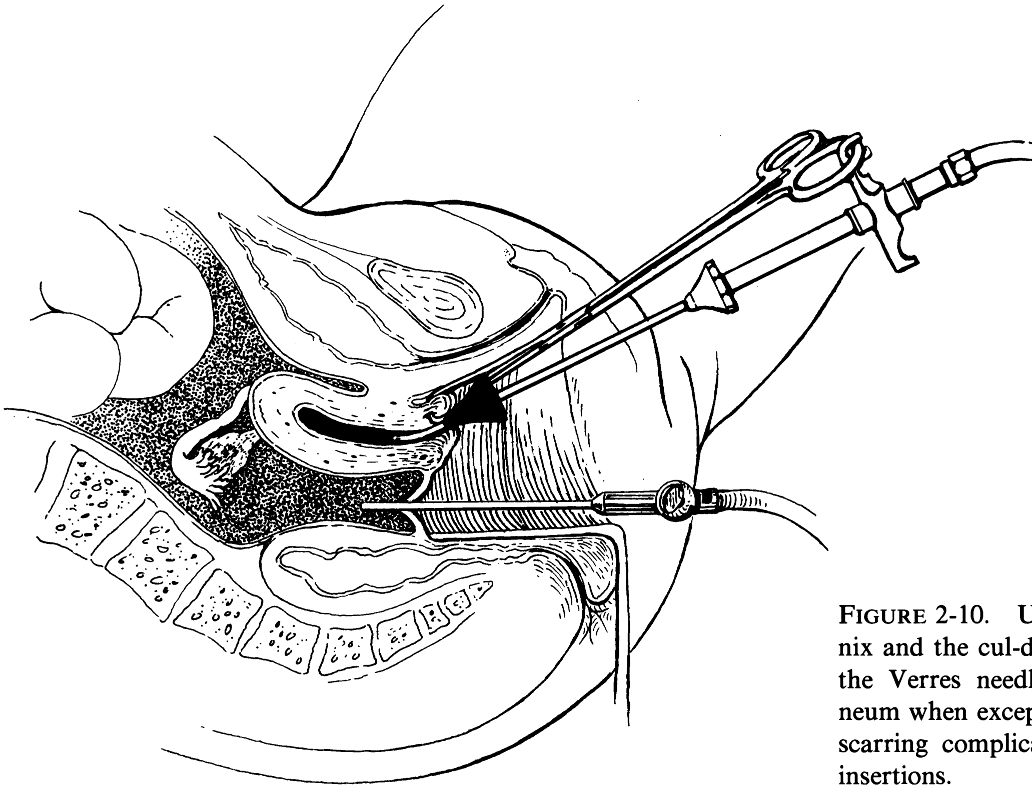


FIGURE 2-10. Use the posterior vaginal fornix and the cul-de-sac as a port for inserting the Verres needle to obtain pneumoperitoneum when exceptional abdominal fat pad or scarring complicates abdominal wall needle insertions.

and the uterus elevated anteriorly while being stretched posteriorly with a posterior retractor. This adequately flattens out the cul-de-sac so that penetration is easy. Half a centimeter of penetration is usually adequate. Gas inserted through the culdocentesis route usually creates slightly higher pressures in the initial phases. Three to six liters can be injected without difficulty, then the procedure carried to the anterior abdominal wall for usual insertion of the sleeve and trocar through the lower border of the umbilicus.

Open Laparoscopy

Occasionally, the anterior abdominal wall may be severely scarred by previous surgery, and the threat of adherent viscera may be increased. In such cases, open laparoscopy using the technique of Hasson has been useful, although it does not guarantee freedom from bowel injury.[18] Open technique can be carried out under general or local anesthesia. If local anesthesia is used, then infiltration is carried down to and through the fascia to the peritoneum. A small, 1-cm incision is made just below the umbilicus. Using the special "S" shaped retractors of Hasson (small deaver retractors), the incision is carried down directly until the fibers of the fascia are seen. The fascia is grasped in two places with a strong hemostat (kocher clamp) and incised between the two clamps. A suture is passed through each edge but not tied and left on the sides of the small incision. The incision is then carried through the peritoneum, and the modified trocar and sleeve of the Hasson instrument inserted directly into the peritoneal cavity with its blunt obturator in place. The cone of the instrument is then slid down into the incision to make an air-tight seal. The sutures previously passed through the fascia edges are brought up to the cleats on the sides of the sleeve and are wrapped around these cleats to stabilize the assembly. The scope can then be passed into the peritoneal cavity, and the pneumoperitoneum can be developed under direct vision.

Uterine Manipulators (Elevators)

A number of uterine manipulators are available for laparoscopic procedures so that all aspects of the uterus and adnexa can be adequately visualized. Movement of the uterus will stretch the adnexa so that folds can be straightened out, all serosal surfaces can be seen adequately, ovaries can be examined on both sides, and all the possible information can be obtained through visualization of these structures.

The most common type of uterine manipulator used in the United States today is the cannulated type of which the suction cannula (Semm) is the classical instrument. The large suction cup of the instrument is designed to hold the cervix; in the center of the suction cup is a projectory cannula approximately 2 to 3 cm in length which extends up to the cervical canal. The suction cup has an opening attached to a fitting on the handle through which vacuum can be applied either by wall suction or simply by a short segment of tubing and a 20-cc syringe with an appropriate clamp. To fix the cup against the cervix, a cannula is inserted into the cervix, the cup is placed flush onto the cervix, and the vacuum applied, fixing the instrument in place. This instrument is easy to place but usually requires exposure of the cervix with a speculum and perhaps even fixation with a single-tooth tenaculum. The cannulated opening is also attached to a fitting on the handle to which a Luer lock is usually fixed so that fluid may be injected into the uterine cavity. The suction cannula may be displaced by a deformed or lacerated cervix or by a large hypertrophied cervix. This may cause the suction to fail or, if there is an obstruction in the cervical canal, injection through the cannula may break the suction and allow the manipulator to be dislodged.

Another intrauterine manipulator is the Cohen cannula with an olive to block the cervical canal and a spring-loaded fixation device that will fix the cannula to a previously attached single-tooth tenaculum. The tenaculum can be placed anteriorly or posteriorly on the cervix, with the curvature of the intrauterine cannula in the axis of the cervical canal.

Recently other manipulators have been introduced. One, the Behrman, is a cannulated variety derived from modification of a forceps instrument. One arm of a toothed tenaculum has been modified to be an intrauterine cannula. The second arm retains its toothed portion which fixes this instrument in place in the uterine cavity. The modified cannula arm with a fixed olive usually fits well into the cervical canal, but in some small uteri it may not. The fixed aspect of the olive may cause a poor seal if injection into the intrauterine cavity is indicated. The Quinonas manipulator utilizes modified ring forceps in the same way. The ring forceps is less traumatic to the cervix than the toothed tenaculum.

In laparoscopy where intrauterine injection is not contemplated, two very convenient uterine manipulators have been designed by Hulka and Sargis. One arm is a uterine sound that fits up into the cervical canal and the other arm retains the single-tooth tenaculum. For fixation the sound is inserted in the uterine cavity, the single-tooth arm is attached to the cervix, and they are held together by a rachet, which fixes the manipulator in place. This can be inserted very quickly and easily either blindly or through a speculum under direct visualization.

Placement of Uterine Manipulator

Place the uterine manipulator on the cervix under direct vision with a speculum in the vagina. The cervix may be stabilized with a single-tooth tenaculum, particularly in situations where there is stenosis of the cervix and minimal dilation may be required, or in instances where uterine displacement requires direct vision to insert the intrauterine portion carefully. Usually exposure of the cervix and fixation with the tenaculum results in more accurate placement.

With a retroverted or retroflexed uterus, insert the intrauterine portion of the cannula in reverse curvature to follow the real axis of the uterus. Once the limit of the intrauterine cannula is reached, rotate through 180°, lifting the uterine fundus out of the cul-de-sac into an anterior position. Then fix the tenaculum or fixing mechanism. If the uterus appears to be fixed in the cul-de-sac, then the manipulator should remain in a reverse position.

Two important possibilities of injury exist when inserting the intrauterine manipulators. The first is pulling out the tenaculum, usually the single-tooth tenaculum from its fixation in the cervical mucosa. If the tenaculum fixes only to the mucosal tissue which can be friable, any tension will pull it through, resulting in a laceration that will cause bleeding. Bleeding can be controlled either by pressure or with a ring forceps if necessary. Occasionally a suture may be required.

The most important possible injury is the perforation of the uterine anterior wall. It happens particularly in the undiagnosed retroversion or retroflexion uterus.

The cannulated uterine manipulators also allow solutions to be injected into the uterine cavity through the hollow cannula (chromotubation). In patients undergoing laparoscopy with local anesthesia, the author has found intrauterine anesthesia to be helpful. Ten to 20 mL of 1% lidocaine is injected through the intrauterine cannula penetrating through the tubal ostium. Blanching and some contraction of the proximal third of the tubes can be observed during this injection.

Diagnostic Laparoscopy

Laparoscopy for diagnosis is particularly apropos in the management and study of infertile patients and should be utilized in all patients in whom diagnosis of acute or chronic pelvic disease is suspected but unproven. Laparoscopy will avoid embarrassing and (in our litigious society) costly diagnostic mistakes that lead to unnecessary and unrewarding laparotomy or failure to make a diagnosis that may become obvious when suspicion turns to catastrophe. There is a small but alarming literature indicating that even the most innocuous exploratory laparotomy to rule out nonexistent appendicitis, ectopic pregnancy, or other presumptive diagnoses can affect the fertility of patients.[45] Careful diagnostic laparoscopy will yield the diagnosis in most cases and avoid prolonged, traumatizing exploratory surgery.

Single- or multiple-puncture techniques are used for diagnostic procedures, and the preference of one over the other should depend on the availability of equipment and the need for manipulation of pelvic organs, severing of adhesions, removal of fluids or blood that may obscure the anatomy, and the pathologic anatomy. The author usually begins diagnostic laparoscopy with a double-puncture laparoscope, utilizing a 10-mm instrument so that, if appropriate, a single-puncture operating instrument can be inserted through the cannula by simply replacing the scope. In many instances the insertion of probes, suction tubes, and/or cautery devices through the channel will be adequate to make a clear diagnosis. In other cases, a second- or even multiple-puncture technique may be necessary. With the recent development of better optics for 5- to 8-mm laparoscopes, the use of these smaller scopes in a double- or multiple-puncture technique has become more popular.

It is necessary for the laparoscopist to adopt a diagnostic regimen that will adequately survey all of the pelvic and abdominal structures. The surgeon should utilize a systematic approach that is not varied from case to case. This may be accomplished in any of a number of approaches, but should include recognition and complete examination of the uterus anteriorly as well as posteriorly. Whenever possible, the laparoscope should be inserted deep into the cul-de-sac to allow omentum, bowel, and adnexal structures to fall out of the way so that the cul-de-sac, peritoneum, uterosacral ligaments, and relevant intraperitoneal structures can be observed. Observe the adnexa in a systematic routine manner, proceeding from one side to the other, depending on the individual operator's choice.

Account for all structures and clearly identify their position in the patient. Manipulation of the uterus with the cannula may frequently aid in this process. The most common error at this point is having the lens too close to pelvic viscera. The scope should be withdrawn until a panoramic view can be obtained. The tube can be brought out of the cul-de-sac where it frequently lies by simply placing the scope beneath the tube and elevating it out of the cul-de-sac. Then back the scope off and survey the entire tube from the fimbria to its insertion in the uterine cornua. Close examination of the fimbria should be carried out to determine agglutination or bleeding such as might be present in an ectopic pregnancy. This systematic review of the pelvic structures should be documented with a drawing in the patient's chart, possibly photographically, or by videotape as well as a dictated operative note. The pelvic structures should be closely observed for alterations in shape or coloration that may be indicative of less obvious pathologic conditions such as early unruptured ectopic pregnancy.

Gynecologic laparoscopy rightfully includes a survey of the abdominal contents. This may be done routinely in a systematic, methodical manner as in the pelvic visualization, usually starting on the right side looking at the cecum and appendix, if possible. The appendix may require manipulation of the cecum for exposure, and the procedure then carried up the right gutter to the base of the liver. The liver edge usually is easily recognized, as is the gallbladder. Biopsy of the liver can be carried out under vision if this is indicated. Visualization can be carried across the upper abdomen to the left upper quadrant and down the left gutter and back into the pelvis. If permanent documentation of conditions seen through the laparoscope is not possible, it is urged that at least one or possibly two more trained individuals who are capable of recognizing pathology be allowed to observe the pathology identified so that the procedure and documentation on the chart can be verified. Biopsy of easily approachable lesions on the serosal surface of the reproductive organs is usually a safe procedure. Bleeding that may occur can easily be controlled with cautery. However, deeper biopsies or cutting into ovaries, tubes, or other structures should only be attempted when more sophisticated methods for control of hemorrhage are available and the operator is experienced in the management of these procedures through the laparoscope. In other cases it may be prudent to observe the need for biopsy, terminate the procedure, and plan to carry out other surgical procedures in an open abdominal approach when the patient has been appropriately informed of the condition and is capable of giving informed consent. In some instances such as unsuspected unruptured ectopic pregnancy, it may not be appropriate to delay the procedure and immediate laparotomy and management may be carried out.

Operative Laparoscopy

In the United States the most common surgical procedure performed with laparoscopy is tubal sterilization of the female. If acceptable to the patient and within the skills of the surgeon, local anesthesia is the anesthesia of choice since in most instances these patients are normal, healthy, parous women who have no evidence of pelvic inflammatory disease or other pathology and are obviously fertile. Therefore, it can be assumed that in most cases the sterilization procedure will be straightforward and rapidly performed. In patients undergoing sterilization, the need for the intrauterine cannula has been questioned and in many instances is not necessary, particularly if the uterus is known to be suspended well anteriorly and it is clear that there is no pelvic inflammatory disease or distortion of the pelvic organs.[26,32] However, in most instances the ability to manipulate the uterus will give the surgeon confidence and facilitate the procedure. The cannula is used if the technique of local anesthesia described in this chapter is used. Intrauterine injection of lidocaine should be carried out and in this case, of course, there is no reason not to leave the cannula in place.

Either a 10- or 12-mm operating laparoscope may be used for visualizing the pelvic viscera. If the operating laparoscope is used, it should have at least a 7-mm operating channel, since a nonelectrical sterilization method requires instruments that are at least this large and for the most recent model of the Wolf Yoon ring applicator, an 8-mm channel is necessary. Of course, double- or multiple-puncture techniques are equally reasonable alternatives (Fig. 2-11) and might be considerably less expensive than replacing an operating laparoscope just to gain the use of one instrument. Currently, in the United States the alternatives for laparoscopic sterilization include bipolar cautery, Fallope™ rings (Yoon), spring-loaded clips (Hulka), and thermal cautery (Semm and Waters).

Selecting a method of tubal sterilization will depend on the availability of the equipment for the application of rings or clips or the availability of bipolar cautery instrument and bipolar electrical generator, the condition of the fallopian tubes, i.e., are they normal or thickened, edematous, adherent, or obscured by adhesions, and the experience of the operator.[8]

There have been numerous studies of the effectiveness/failure rate of sterilization methods. The failure rates of selected laparoscopic methods of tubal sterilization are given in Table 2-2. These rates reflect statistics generated by large series in which the procedures are done by one or more individuals usually for the purpose of determining the effectiveness of the method. Therefore, failure can mean any or all of the following: inability to complete the procedure, mechanical failure, tubal patency determined by chromotubation or hysterosalpingography, or a pregnancy episode, either intrauterine or ec-

TABLE 2-2. Failure Rate for Selected Laparoscopic Methods of Tubal Sterilization

Method	Failure Rate
Bipolar coagulation (with or without division)[23]	4–8: 1,000
Low thermal endocoagulation (Semm)[40,41]	0: 1,000
Shielded thermocautery[30,46]	1.6: 1,000
Fallope ring[50]	1–5: 1,000
Spring-loaded clip[23]	4–8: 1,000

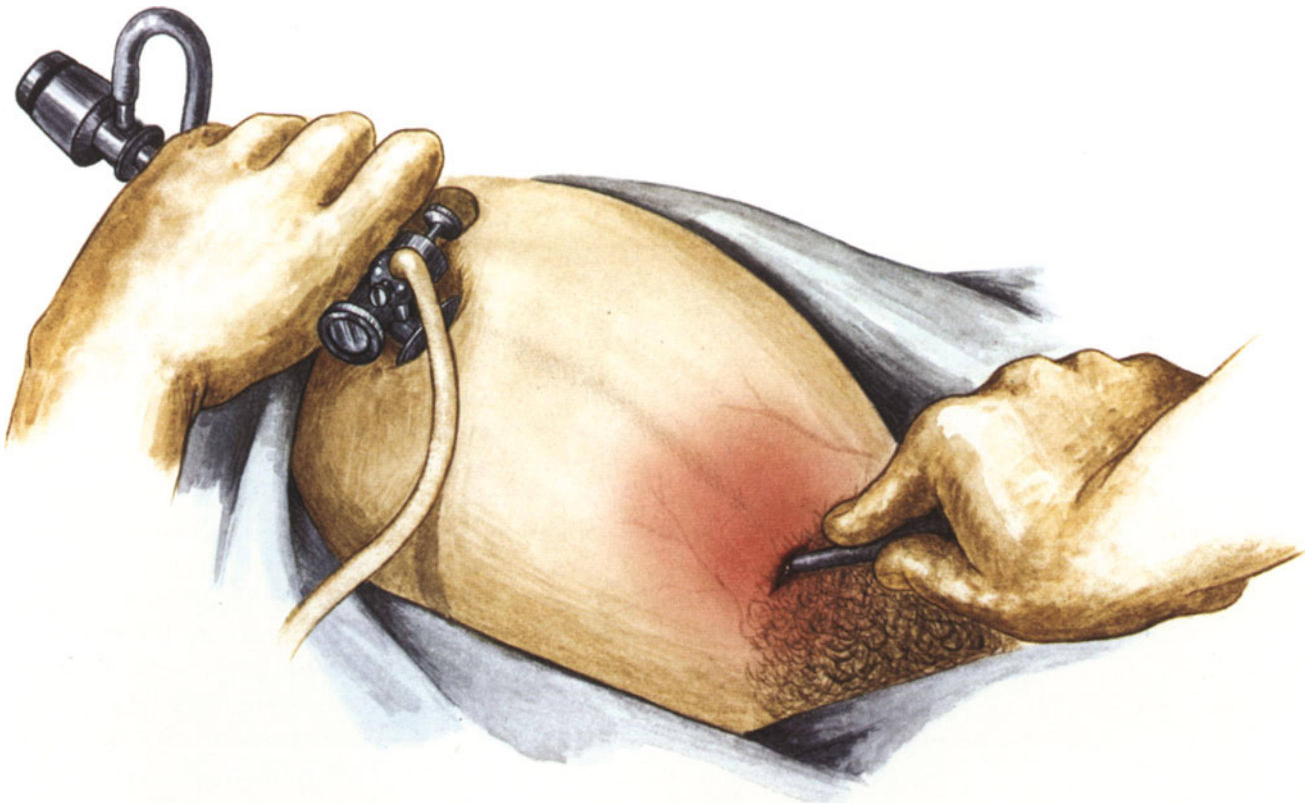


FIGURE 2-11. Use transillumination of supra pubic abdominal wall to avoid blood vessels during insertion of the second puncture. The laparoscope may also be used to provide resistance to the downward pressure during the insertion thrust.

topic. Patient population can also distort failure rate statistics. For example, a patient population that includes a large number of patients with pelvic inflammatory disease (PID) will yield very different results from a population with a low PID rate. Thus, these failure rates are guidelines and certainly cannot be used as factual evidence of the superiority of one method over another.

Tubal sterilization should only be undertaken as a permanent procedure, and patients' informed consent should contain a clear statement to this effect. Nevertheless, despite the most careful selection and execution of method, there is a known failure rate. Therefore, in the interest of effective risk management, informed consent should contain wording that includes the possibility of failure and that specifically excludes an unconditional guarantee.

As the number of total sterilizations increases and as the age of patients desiring sterilization decreases, one can logically expect an increase in the number of patients desiring reanastomosis of fallopian tubes. Several studies have been undertaken in an attempt to identify the patient who is most likely to desire reanastomosis of the fallopian tubes. To date, no clear profile of this patient has been identified.[29] However, factors that may increase the likelihood of regret and desire for reanastomosis of the tube are unstable family relationships at the time of sterilization, or very young women of low parity.[13]

Both bipolar cautery and Fallope ring destroy approximately the same amount of tubal tissue, but spread of tissue destruction from cautery is not predictable. Reports of reanastomosis following Fallope ring application have generally shown a higher success rate than those following cautery, either unipolar or bipolar.

Recent reports have shown that successful reanastomosis following clip application is of a very high order, indicating that clip sterilization may be considerably more reversible than any of the other methods.[16,22,50]

Technique

After visualization of the pelvic contents, the author, even though a general anesthetic is used, applies a local anesthetic to the fallopian tubes, usually in the form of bupivacaine 0.5% in the amount of 5 mL on each side. This seems to minimize postoperative pain, particularly in patients having rings or clips applied. Before treatment of the tubes by any method, clearly identify the fallopian tube. If possible, the fimbria should be observed as well as evidence of tubal patency. When a patient appears to have tubal obstruction related to inflammatory disease, it is appropriate to test for tubal patency by injecting methylene blue or other appropriate dye through the uterine cannula. Occasionally proximal closure of a distally occluded oviduct may result in the formation of a hydrosalpinx at a later date. If tubal occlusion can be demonstrated, then further tubal treatment not only may be unnecessary, but also may result in a closed space that may cause future problems for the patient. When using local anesthetics, manipulation of the tubes may cause increased discomfort to the patient. Therefore, do not make an issue of exposing the fimbria unless there is some question about the identification of the tube or its patency.

Fallope ring application avoids the risk of cautery and is a proven method of tubal occlusion. Its application to a structure other than the fallopian tube is extremely difficult and unlikely to occur. The Fallope ring does not create any contiguous tissue injury, and it is easy to determine how much tubal tissue is involved in the ring, whether the ring is intact, and whether blanching of the enclosed tissue indicates good ischemic reaction.

Not all tubes can be easily manipulated for ring application. Tubes with thickening or inflammatory reaction may be more likely injured by sectioning or by injury to the mesosalpinx. When applying rings, use one prong of the tongs to lift the tube away from the mesosalpinx and then grasp only the tube itself. Frequently, the lifting prong can be seen tenting the mesosalpinx below the tube. This allows a good 1-cm loop of tube to be drawn up into the instrument without discomfort. If too much mesosalpinx is picked up with the tongs, the patient under local anesthesia will usually have some discomfort, and from the standpoint of technique, a smaller portion of the tube is involved in the ring and the likelihood of failure is increased. If the tube is thickened or edematous, a milking action achieved by alternate takeup and release of the tongs will allow the fluid to be squeezed out of the tube and full retraction accomplished without transsection or injury.

After bilateral application of Fallope rings, the two sites should be carefully inspected to ensure that the ring is intact (since occasionally rings are split or damaged by irregularities on the loading cone of the applicator) and that an adequate loop (at least 1 cm) of tube is within the ring with evidence of good blanching. Occasionally a ring will slip off the tube almost immediately. Therefore the last maneuver before removing the laparoscope should be to inspect both sides one more time. If the loop appears inadequate the tube may be regrasped and drawn into the applicator pushing the ring down further or a second ring may be applied (in series) thus giving a longer loop. Rings

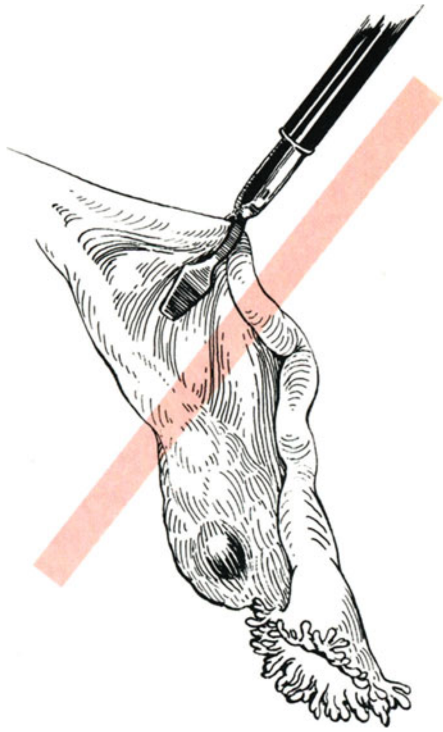


FIGURE 2-12. Over-reaching the tube with the flat area of the Kleppinger forceps may reduce the tubal and endosalpingeal coagulation, cause increased pain when using bipolar cautery with local anesthesia and may result in wide destruction of the mesosalpinx possibly interfering with ovarian blood supply.

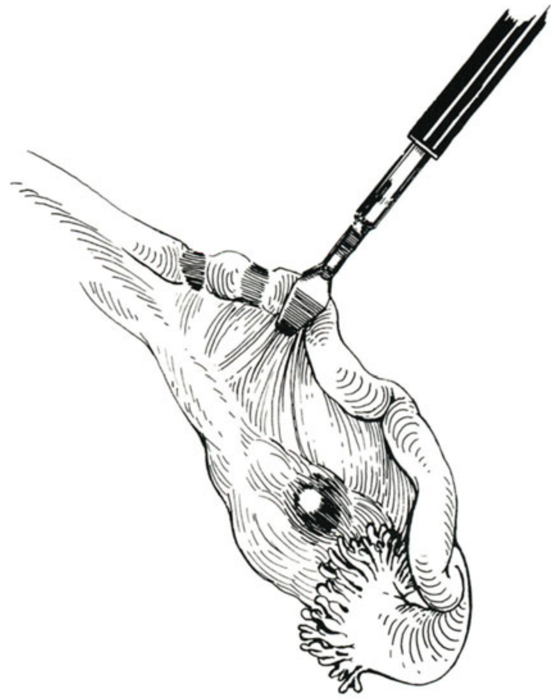


FIGURE 2-13. Accurate placement of the flat tips of the Kleppinger bipolar instrument ensures complete dessication of all tubal tissue particularly when monitored by an ammeter to determine when tissue conductivity has dropped by at least 50%. Wide destruction of the mesosalpinx should be avoided.

should not be placed in parallel since a closed length of vital tubal tissue may result giving rise to a hydrosalpinx.

When the bipolar cautery is used, the forceps should be applied directly to the tube so that the flat or spatulate portion of the Kleppinger forceps grasp the tube rather than reach beyond the tube to the mesosalpinx[3] (Figs. 2-12 and 2-13). The Hirsch bipolar tongs may minimize this possibility. Only the tube should be burned, and the burn should be carried out until the ammeter on the bipolar signal generator begins to drop, indicating desiccation of the tissue. It is not necessary to hold the burn until the ammeter has dropped all the way to zero. Since coagulation of protein is the objective of this procedure, browning or frying of the tissue is not necessary; further, it may only increase the area of contiguous burn of the mesosalpinx and may lead to increased risk of fistula. Cutting of the coagulated tube is not advised since no real advantage is gained.[20] It may lead to an increased risk of fistula formation, subsequent failure and bleeding from the mesosalpinx. A high percentage (approximately 50%) of pregnancies occurring after failed tubal coagulation result in ectopic gestation.[11,28] Overburning of the mesosalpinx results in discomfort to the patient under local anesthesia and may interfere with ovarian blood supply later on. Usually two or three contiguous burns are made on each tube. Each burn makes the likelihood of reanastomosis more remote.

Thermocoagulation is another sterilization method which has the advantages of cautery but without any electrical transfer through or to the patient. The

Waters instrument uses a retractable hook to pull the fallopian tube into a Teflon shield.[17] Battery-generated electrical current heats the hook, accomplishing division and coagulation of the fallopian tube. No electrical current passes through the patient's body or tissue because the electrical circuit is complete within the hook. A similar method is described by Semm using unshielded forceps (crocodile forceps) which likewise coagulate the tissue with heat rather than an electrical current.[40] The tube can then be cut with hooked scissors.

Spring-loaded clips (Hulka) should always be applied exactly perpendicular to the axis in the midportion of the tube. With the Hulka clip, if care is taken, the clip can be closed without locking the spring device and the tube manipulated using the jaws of the clip as a manipulating forceps. The clip should be placed on the tube so that on closure, a portion of the tubal tissue will be forced into the hinged portion of the clip and the tips of the clips should pass beyond the tube onto the mesosalpinx. If one clip does not appear to be well placed, it should be supplemented by either another clip or by another technique, if necessary. Improperly placed clips, even if the spring is locked, can be removed by traction applied to the sides of the clip. Little or no damage to the tube results from this maneuver and a properly placed clip can be placed over the same area. Inspection of the clip site should be carried out after application to ensure that the tube is crossed perpendicularly by the clip and that the clip is properly closed and locked and the tip extended onto the mesosalpinx.

Other Laparoscopic Surgery

Extremely sophisticated surgical techniques applicable through laparoscopy are currently being described and recommended by various authorities. Semm and others have recommended laparoscopic surgical techniques which include excision of adnexa, small subserous fibroids, ruptured and unruptured ectopic pregnancy, appendectomy, and other abdominal operations done entirely through the laparoscope.[14] The application of laser techniques to laparoscopic surgery is becoming popular. It is not within the scope of this chapter to discuss these highly sophisticated and as yet not universally employed techniques. They are a logical extension of present laparoscopic knowledge and skill. Those who find these laparoscopic procedures suitable to their talents and interests are urged to pursue these highly specialized techniques under proper supervision and with appropriate equipment.

In all laparoscopic procedures, occasional opportunities for less sophisticated operative techniques occur. Lysis of adhesions can be carried out easily through either single- or multiple-puncture techniques (Fig. 2-14). These situations include clear-cut adhesive bands that can be released under clear vision and in which only minimal bleeding controlled by coagulation can be expected. Unipolar coagulation scissors, hooks, and needles are available for this purpose and should be utilized. Salpingostomy both for release of simple fimbrial adhesions and for fimbrial agglutination is appropriate through the laparoscope. Removal of a small unruptured ectopic pregnancy is possible when the tube can be stabilized, the incision made over the ectopic pregnancy, and under circumstances where bleeding can be controlled by coagulation rather than by mass ligation.

Management of ovarian cysts by laparoscopic technique is controversial.[27] Obviously, perforation or opening of a dermoid, mucin-containing, or malignant ovarian tumor would be considered disastrous. However, the management

FIGURE 2-14. Not infrequently, adhesions may obscure or distort the pelvic structures. They may be easily dissected usually without bleeding. A ground plate always should be in place when dissecting with a unipolar instrument.

of ovarian cysts in young women is probably safe and will frequently relieve symptoms and doubts without the risk, inconvenience, and expense of abdominal laparotomy. Ovarian cysts usually should be managed by multiple-puncture technique because this will allow transillumination of the cystic structure and careful manipulation of the cystic structure. Obviously, if superficial excrescences exist, then the likelihood of neoplasia is increased and laparoscopic manipulation should be terminated. However, if the cyst is smooth and transilluminates readily, needle puncture and evacuation can be easily accomplished with specially designed aspiration needles. The fluid can be evacuated into a syringe and sent to the laboratory for cytologic studies if indicated. In addition, a biopsy of the collapsed cyst wall can then be easily made to confirm diagnosis.

Early endometriosis can be managed by laparoscopic surgery. Histologic diagnosis can be made by biopsy of suspicious lesions. Lesions can be eliminated by direct cautery, using a bipolar or unipolar instrument as the anatomical conditions will allow. If suspension of the uterus is indicated following treatment of mild or moderate endometriosis, this can be performed laparoscopically in accordance with techniques described by Rogers et al.[38]

Complications of Laparoscopy

As in all surgical procedures, laparoscopy carries the risk of specific complications as well as the usual surgical complications of inadvertent hemorrhage, infection, and anesthetic accident. Laparoscopic procedures have a relatively low rate of operative complications and mortality. Most of the severe complications of laparoscopy discussed in older texts occur only rarely and are usually a result of inadequate training or failure to follow the fundamental principles of the procedure. Education, experience, proper maintenance of the equipment, and selection of the proper procedure for the conditions at hand can prevent the severe complications.

The first source of minor complications are accidents associated with the insertion of the intrauterine cannula used to manipulate the uterus during the procedure. A careful pelvic examination prior to the insertion of these instruments is required so that the exact position of the uterus can be ascertained. Most cannulas are constructed to curve anteriorly. Obviously a careless insertion of such a curved instrument into the retroverted uterus can result in perforation of the anterior uterine wall. This does occur in approximately 3% of cases and is entirely preventable.[7,48] At least one case of fatal infection has been traced to this source.[34] The Semm suction cannula is relatively safe; however, anterior perforation can occur with this instrument as well. The longer, somewhat more easily inserted Hulka cannula or Quinones or Behrman modification of the Hulka cannula can result in a higher penetration of the uterine fundus than with the Semm cannula. Using a Cohen cannula and a single-tooth tenaculum can also result in perforation of the retroflexed uterus. Care should be taken in patients who are undergoing laparoscopy following abortion or in the puerperium since the uterus is usually larger, softer, and more flexible in the isthmic portion. In these cases a bulkier intrauterine instrument can be used such as the Sargis cannula. In some instances, the use of a larger suction cannula or a cervical dilator of appropriate size may allow better manipulation of the uterus with less danger of perforation. If perforation of the uterus occurs, patients should receive intravenous prophylactic antibiotics intraoperatively. Usually one or two doses will suffice. Since the patient is undergoing laparoscopy, careful examination of the perforation site for hemorrhage should be included in the laparoscopic procedure and cautery or other surgical procedure to control hemorrhage instituted as required.

The next source of possible complication is insertion of the (Verres) needle used to develop pneumoperitoneum. Penetration of the bowel, stomach, bladder, or, occasionally in very thin patients, retroperitoneal or vascular injuries have occurred. In thin patients with a relaxed abdominal wall under general anesthesia, direct insertion of the trocar and sleeve according to the previously described technique will avoid possible injury with the Verres needle. Since such insertion is outside the normal boundaries of the peritoneal cavity, injury to underlying structures is very unlikely. However, if the Verres needle is to be used, tenting the anterior abdominal wall by grasping the skin and raising the abdominal wall is indicated. If the patient is under local anesthesia, the patient's own muscular tone and resistance to pressure will allow quick penetration without injury to underlying structures.

Very little permanent damage is done when the stomach or bowel is inadvertently entered. However, it is important to recognize this possibility and simply aspirating through the needle hub with a syringe can check for this. If such penetration has occurred, then a second needle should be placed, pneumoperitoneum developed, and a scope inserted to assess damage created by the initial insertion. If necessary, lavage to the peritoneal cavity can be carried out. With bladder injury a Foley catheter can be inserted to check for continued hematuria and to keep the bladder contracted. Stomach injuries are usually associated with general anesthesia, particularly when intubation has been omitted, the tube incorrectly inserted or intubation started late, allowing a significant amount of air to enter the stomach. Peritoneal lavage and intravenous antibiotics for prophylaxis are indicated and the patient should be observed for development of peritonitis when visceral penetration occurs.

Minor complications of Verres needle insertion include inadvertent gas dissemination into closed spaces such as into the subcutaneous tissues or in the retroperitoneal space in very obese patients. Retroperitoneal emphysema also may occur. This is more likely when penetration is well below the edge of the umbilicus. In some patients, entry into the omental sac has resulted in an omental emphysema, which can obscure the peritoneal contents. Insertion of the scope into an emphysemal area gives a typical honeycombed appearance which should be readily recognizable. In these instances, if the emphysema is subcutaneous or retroperitoneal, the needle should be left in place, a second needle inserted into the peritoneal cavity, and a pneumoperitoneum developed which will help to deflate the subcutaneous or retroperitoneal emphysema.

Retroperitoneal or subcutaneous emphysema undetected can enter the mediastinum and cause pulmonary and circulatory complications.

The most dreaded injury of laparoscopy is laceration of a great vessel when the trocar is inserted.[35] The trocar should be sharp and directed properly to prevent unusual force on insertion. The insertion should be well controlled. Once the trocar has entered the peritoneal cavity, it is wise to pull the trocar back so that the sleeve can be advanced into the peritoneal cavity. Injury to the great vessels will immediately be recognized on removal of the trocar or insertion of the scope since the field will be filled with blood. In this case, do not panic; the incision should be enlarged to allow pressure to be placed against the aorta and vena cava to control bleeding until a vascular surgeon can be consulted. If the patient is in an operating room that is not adequate for extensive vascular surgery, up to and including cardiopulmonary bypass, the patient should be moved to a suitable room.

Occasionally, trocar penetration of the stomach or bowel can occur. When this is recognized, leave the laparoscope in place and make an incision parallel to the trocar sheath tract so that the defect can be readily recognized and rapidly managed by simple purse string enclosure, if that is indicated. Surgical consultation of course should be obtained in such instances and the original procedure should be completed, if at all possible.

Bleeding from the mesosalpinx or pelvic adhesions can be a complication of the manipulation of the pelvic organ in preparation for sterilization or diagnostic laparoscopy. In most cases, the bleeding can be managed easily by simple cautery, using either bipolar forceps. When necessary, a suction cannula coagulator utilizing unipolar cautery can be used to remove excess blood or fluids and cauterize bleeding points. These instruments are well insulated and present little risk of intra-abdominal burns when used appropriately. Occasionally, injury to fallopian tube or mesosalpinx can be managed by the application of silastic ring or appropriate clip.

Finally, bleeding can occur in the anterior abdominal wall, usually from injury to the inferior epigastric artery or its branches during insertion of a second-puncture instrument. For this reason, we recommend second-puncture instruments be inserted in the midline since this may avoid injury to the epigastric vessels or their branches. Second puncture should always be inserted under direct vision after transillumination of the abdominal wall to ascertain the presence of vessels that can be avoided. Should injury to the vessel result in a hematoma formation on the anterior abdominal wall, the vessel can usually be ligated utilizing a clever technique described by Soderstrom and Corson.[43] A ligature is passed through the skin incision and, with combined endoscopic control, into the abdominal cavity and out through the skin in such a way as to complete a ligature of the epigastric vessel. Placement and security can be confirmed endoscopically.

Infections, dehiscence, and herniations of the laparoscopic abdominal incision are rare but have been reported. Infections are usually treated with appropriate antibiotics, and if abscess forms, drainage may be necessary. Dehiscence usually involves protrusion of the omentum and in some cases portions of the small bowel through the opening.[4,25,39,42] Straightforward surgical management and antibiotic therapy are usually sufficient once it has been ascertained that there is no injury to the bowel.

Careful planning of procedures and adherence to appropriate technique planned to suit the physical conditions and goals of the procedure have all but eliminated the serious complications of laparoscopy. However, complications, though rare, require immediate evaluation. Observation or delayed treatment has no place in management of laparoscopic complications.

Care and Maintenance of Laparoscopic Equipment

Laparoscopes, light cords, and electrical cords should not be subjected to extreme heat or steam pressure. Laparoscopes that may be autoclaved are on the market. However, the useful life of these instruments is brief and generally considered unacceptable. Therefore, autoclaves are not used to sterilize this equipment. Gas sterilization for scopes, light cords, and electrical cords may be carried out periodically but should not be used with each application. Numerous studies have shown that adequate sterilization of scopes and light cables can be obtained with aldehyde (Cidex) soaking techniques.[21,24,47] When repeated use of instruments during the day is expected, a 20-minute immersion in the aldehyde solution between cases is sufficient for sterilization. Sleeves, trocars, and other equipment can be autoclaved (flashed) between cases if necessary.

Laparoscopy should be carried out under the general principles of sterile operating room technique. The operating room (ancillary equipment, drapes, etc) should be sterile as it is for any other operative procedure. Sterile techniques for operators and assistants should be the same as sterile technique for any endoscopic procedure. Head covering, mask, and gloves should be used and touch sterile technique be employed. The maintenance of equipment is a joint responsibility of the surgeon and the hospital.

Prior to starting surgery the surgeon needs to check all equipment, including the electrical equipment, light sources, light cables, signal generators, and conduction cords to be sure that all are functioning properly. The surgeon should also check the gas insufflation equipment, making certain that a sufficient supply of appropriate gas is attached to the insufflator and that the insufflator is functioning properly. The surgeon should inspect the valves of the sleeves that are expected to be used in the procedure, both the primary telescopic sleeve and any multiple-puncture instruments to be used. All telescopes should be inspected to be sure of adequate visibility. It is the responsibility of the surgeon to see that any special equipment such as ring applicators, scissors, hooks, and suction apparatus are functioning properly and are properly sterilized. The surgeon should also inspect the trocars to be used for sharpness and should instruct the technicians and nurses on the technique of sharpening these trocars if necessary. Above all, the surgeon should be sufficiently experienced and skilled to be able to communicate his or her needs to the operating room personnel.

The hospital's responsibility is first to set aside an area for the performance of laparoscopy, where all equipment and necessary accoutrements can be assembled in one place, remembering that there are light sources, electrical generator, and insufflation equipment that must be arranged beside the operating table. The operating table must be one that can be moved so that the patient can be in a semi-lithotomy position and can be moved rapidly from flat to Trendelenburg position, if necessary. There should be sufficient space for additional equipment such as video recorders if these are available.

The hospital should provide equipment needed for laparoscopic services at the level of proficiency of the staff surgeons who will be scheduling cases. An important responsibility of the hospital is to provide and train personnel to maintain equipment and to assist knowledgeably in laparoscopic surgery. Laparoscopic surgery is an exquisitely simple and easy approach to many pelvic procedures, but it requires the interrelationship of surgeon, staff, and patient, and, most importantly, all of the myriad parts must function together to produce good surgical results.

References

1. Aldrete JA, Tan ST, Carrow DJ, et al: "Pentazepam" (Pentazocine + Diazepam) supplementing local analgesia for laparoscopic sterilization. *Anesth Analg* 1976; 55:177–181.
2. Aribarg A: Epidural analgesia for laparoscopy. *J Obstet Gynaecol Br Comm* 1973; 80:567–568.
3. Ayers JWT, Johnson RS, Ansbacher R, et al: Sterilization failures with bipolar tubal cautery. *Fertil Steril* 1984; 42:526–530.
4. Bishop HL, Halpin TF: Dehiscence following laparoscopy: Report of an unusual complication. *Am J Obstet Gynecol* 1973; 116:585–586.
5. Bridenbaugh LD, Soderstrom RM: Lumbar epidural block anesthesia for outpatient laparoscopy. *J Reprod Med* 23:85–86, 1979.
6. Brooks PG, Marlow J: Indications and contraindications. In Phillips JM (ed): *Laparoscopy.* Baltimore, Williams & Wilkins Co, 1977, pp 52–59.
7. Chi I, Feldblum P: Uterine perforation during sterilization by laparoscopy and minilaparotomy. *Am J Obstet Gynecol* 1981; 139:735–736.
8. Cibils LA: Gynecologic Laparoscopy: Diagnostic and Operatory, in Zuspan FP (ed): *Current Concepts in Obstetrics and Gynecology.* Philadelphia, Lea & Febiger, 1975.
9. Cohen MR: What's new in endoscopic still photography. *J Reprod Med* 1984; 29:589–591.
10. Copeland C, Wing R, Hulka JF: Direct trocar insertion at laparoscopy: An evaluation. *Obstet Gynecol* 1983; 62:655–659.
11. Cunanan RG, Courey NG, Lippes J: Complications of laparoscopic tubal sterilization, in Phillips JM (ed): *Endoscopic Female Sterilization: A Comparison of Methods.* Downey, California. American Association of Gynecologic Laparoscopists, 1983, pp 167–174.
12. Dingfelder JR: Direct laparoscope trocar insertion without prior pneumoperitoneum. *J Reprod Med* 1978; 21:45–47.
13. Divers WA: Characteristics of women requesting reversal of sterilization. *Fertil Steril* 1984; 41:233–236.
14. Frangenheim H: *Diagnostiche und Operative Laparoskopie in der Gynakologie. Ein Farbatlas.* Munich, Hans Marseille Verlag GmbH, 1980.
15. Friedrich ER: Laparoscopy, in Martin PL (ed): *Ambulatory Gynecologic Surgery.* Littleton, MA, PSG Publishing Co Inc, 1979, pp 219–283.
16. Gomel V: Microsurgical reversal of female sterilization: A reappraisal. *Fertil Steril* 1980; 33:587–597.
17. Gunning JE, Tomasulo JP, Garite T: Laparoscopic tubal sterilization using thermal coagulation. *Obstet Gynecol* 1979; 54:505–509.
18. Hasson HM: Open laparoscopy for female sterilization, in Phillips JM (ed): *Endoscopic Female Sterilization: A Comparison of Methods.* Downey, CA, The American Association of Gynecologic Laparoscopists, 1983, pp 25–30.
19. Henry-Suchet J, Soler A, Loffredo V: Laparoscopic treatment of tuboovarian abscesses. *J Reprod Med* 1984; 29:579–582.
20. Hirsch HA, Neeser E: Bipolar tubal sterilization: An eight-year experience, in Phillips JM (ed): *Endoscopic Female Sterilization: A Comparison of Methods.* Downey, CA, The American Association of Gynecologic Laparoscopists, 1983, pp 83–88.
21. Huezo CM, DeStefano F, Rubin GL, et al: Risk of wound and pelvic infection after laparoscopic tubal sterilization: Instrument disinfection versus sterilization. *Obstet Gynecol* 1983; 61:598–602.
22. Hulka JF: The spring clip: Current clinical experience, in Phillips JM (ed): *Endoscopic Female Sterilization: A Comparison of Methods.* Downey, CA, The American Association of Gynecologic Laparoscopists, 1983, pp 63–70.
23. Hulka JF: External occlusive devices. Presented at Thirteenth Annual Meeting Clinical Symposium of Gynecologic Endoscopy of the American Association of Gynecologic Laparoscopists, Frontiers in Sterilization. Las Vegas, November 1984.

24. Hulka JF, Soderstrom RM, Corson SL, et al: Complications Committee of the American Association of Gynecologic Laparoscopists First Annual Report. *J Reprod Med* 1973; 10:301–306.
25. Keith L, Webster A, Houser K, et al: Laparoscopy for puerperal sterilization. *Obstet Gynecol* 1972; 39:616–621.
26. Khandwala SD: Development of a simplified laparoscopic sterilization technique. *J Reprod Med* 1984; 29:586–588.
27. Kleppinger RK: Ovarian cyst fenestration via laparoscopy. *J Reprod Med* 1978; 21:16–19.
28. Kleppinger RK: An analysis of 7,000 laparoscopic sterilizations: Unipolar, bipolar and mechanical occlusive, in Phillips JM (ed): *Endoscopic Female Sterilization: A Comparison of Methods.* Downey, CA, The American Association of Gynecologic Laparoscopists, 1983, pp 71–82.
29. Leader A, Galan N, George R, et al: A comparison of definable traits in women requesting reversal of sterilization and women satisfied with sterilization. *Am J Obstet Gynecol* 1983; 145:198–202.
30. Loffer FD, Pent D: Pregnancy after laparoscopic sterilization. *Obstet Gynecol* 1980; 55:643–648.
31. Melega C, Marchesini FP, Bellettini L, et al: Diagnostic value of laparoscopy in endometriosis and infertility. *J Reprod Med* 1984; 29:597–600.
32. Navlekar US: Navlekar's technique of laparoscopic sterilization without vaginal manipulation. Presented at the 8th Annual Conference of the Bombay Obstetrics and Gynecological Society, Bombay, June 1980.
33. Penfield AJ: Laparoscopic sterilization under local anesthesia: 1200 cases. *Obstet Gynecol* 1977; 49:725–727.
34. Peterson HB, DeStefano F, Rubin GL, et al: Deaths attributable to tubal sterilization in the United States, 1977 to 1981. *Am J Obstet Gynecol* 1983; 146:131–136.
35. Peterson HB, Greenspan JR, Ory HW: Death following puncture of the aorta during laparoscopic sterilization. *Obstet Gynecol* 1982; 59:133–134.
36. Phillips JM, Hulka JF, Peterson HB: American Association of Gynecologic Laparoscopists' 1982 membership survey. *J Reprod Med* 1984; 29:592–594.
37. Piver MS, Lele SB, Barlow JJ, et al: Second-look laparoscopy prior to proposed second-look laparotomy. *Obstet Gynecol* 1980; 55:571–573.
38. Rogers SF, Lotze EC, Grunert GM: Endometriosis then and now. *J Reprod Med* 1984; 29:613–620.
39. Sauer M, Jarrett JC II: Small bowel obstruction following diagnostic laparoscopy. *Fertil Steril* 1984; 42:653–654.
40. Semm K: Endocoagulation: A new field of endoscopic surgery. *J Reprod Med* 1976; 16:195–203.
41. Semm K: Endocoagulation: A nearly 99% effective method of tubal sterilization, in Phillips JM (ed): *Endoscopic Female Sterilization: A Comparison of Methods.* Downey, CA, The American Association of Gynecologic Laparoscopists, 1983, pp 89–104.
42. Smith AM: Rupture of abdominal wound after laparoscopy. *Br Med J* 1974; 1:159.
43. Soderstrom RM, Corson SN: Emergencies during and after laparoscopy. *Contem OB GYN* 1982; 20:104–116.
44. Spielman FJ, Hulka JF, Ostheimer GW, et al: Pharmacokinetics and pharmacodynamics of local analgesia for laparoscopic tubal ligations. *Am J Obstet Gynecol* 1983; 146:821–824.
45. Trimbos-Kemper T, Trimbos B, vanHall E: Etiological factors in tubal infertility. *Fertil Steril* 1982; 37:384–388.
46. Valle RF, Battifora HA: A new approach to tubal sterilization by laparoscopy. *Fertil Steril* 1978; 30:415–422.
47. Wheeles CR: Letters. *AORN J* 1973; 18:379.
48. White MK, Ory HW, Goldenberg LA: A case-control study of uterine perforations documented at laparoscopy. *Am J Obstet Gynecol* 1977; 129:623–625.

49. Xygakis AM, Politis GS, Michalas SP, et al: Second-look laparoscopy in ovarian cancer. *J Reprod Med* 1984; 29:583–585.
50. Yoon I: The Yoon ring as compared with other sterilization methods, in Phillips JM (ed): *Endoscopic Female Sterilization: A Comparison of Methods.* Downey, CA, The American Association of Gynecologic Laparoscopists, 1983, pp 213–225.
51. Zevallos H, Shah Y, Moody L: Outpatient laparoscopy with local anesthesia. *Int J Gynaecol Obstet* 1980; 17:379–381.

3 Hysteroscopy

Jamil A. Fayez

Hysteroscopy, the direct investigation of the interior of the uterine cavity, was, until the early seventies, of controversial value. For nearly a century the procedure continued to have more opponents than proponents; in this respect it can be likened to laparoscopy and microsurgical tuboplasty at the eve of their introduction to gynecologic surgery.

Most recently, hysteroscopy has developed into a highly sophisticated and effective technique with increasing applicability. Hysteroscopy is no longer a procedure looking for an indication; its diagnostic and operative value has been well established. With the recent development of fiberoptics as a reliable, high-intensity light source without danger of thermal injury, and with improved methods of distending the uterus, hysteroscopy has attained diverse applications in both diagnostic and therapeutic procedures. The author firmly believes that the time will come when no gynecologist can be considered thoroughly trained without having mastered this endoscopic technique.

Instruments

Three types of hysteroscopes are in common use: the panoramic, the contact, and the microcolpohysteroscope.

The panoramic hysteroscope is a modified version of the cystoscope and is manufactured by Storz, Wolf, ACMI, and Machida. The first three manufacturers make a telescope 4 to 6 mm in diameter with a fore-oblique lens system, whereas Machida's telescope has 180° lens system providing a direct vision. An external stainless steel sheath of approximately 7 mm in diameter is used for the introduction of the telescope. This sheath is equipped with stopcock-controlled channels for the introduction of the distending medium and the passage of ancillary instruments. Storz and Machida provide an obturator for easy introduction of the sheath. Ancillary instruments introduced through intrauterine manipulation and operative procedures include different types of forceps, scissors, probes, suction cannulas, and curettes. These instruments can be flexible or rigid. The latter are easier to handle and more efficient in operative hysteroscopy. The author believes that there should be no place for flexible instruments in operative hysteroscopy. The fiberoptic cable used for external light transmission is the same as that utilized for routine laparoscopy.

The contact hysteroscope manufactured by the MTO Company in Paris and distributed in the United States by Advanced Biomedical Instruments has at its proximal end an ingenious light trap that collects ambient room light. Therefore, external light is reflected into the uterine cavity through the hysteroscope to provide intrauterine visualization without expansion of the uterine cavity. Contact hysteroscopy is performed with the objective lens of the telescope in contact with the structure under observation. Lack of a panoramic view of the intrauterine cavity necessitates careful interpretation of findings and curtails operative hysteroscopy. The author believes that contact hysteroscopy is much less productive than panoramic hysteroscopy and does not recommend its use. However, some hysteroscopists use the contact hysteroscope to visualize the interior of the pregnant and postpartum uterus and in the staging of endometrial carcinoma.[1]

The Hamou microcolpohysteroscope is a new instrument that provides for observation in both panoramic and contact modes. It is manufactured by Karl Storz of West Germany and is equipped with a lens system that permits observation at magnification of 1–150×. The telescope is 4 mm in diameter, and a 5.2-mm sheath allows insufflation with carbon dioxide (CO_2) which is the only distending medium used with this type of hysteroscope. This new instrument may prove to be of value for the reproductive endocrinologist as well as for the gynecologic oncologist.

Distension Media

The uterine cavity is a potential space; its distension facilitates diagnosis and allows the performance of operative procedures. The distension media currently used are high molecular weight dextran, dextrose 5% in water, and CO_2 gas insufflation.

High Molecular Weight Dextran (Hyskon). Hyskon has an average molecular weight of 70,000 and is made of 32% dextran 70 in 10% dextrose. It is an optically clear fluid with high viscosity and a high refractory index. It is electrolyte-free, nonconductive, biodegradable, and nontoxic. It is nonmiscible with blood and therefore is particularly valuable in operative hysteroscopy.

Theoretically, anaphylaxis manifested by hypotension can occur, as Hyskon is a antigenic polysaccharide, but the author has never encountered such reactions. The only practical disadvantage of using Hyskon is its stickiness to instruments as it dries. Unless the instruments are immediately immersed in warm water and thoroughly washed after each use, the stopcocks will jam and the instruments will not function properly during subsequent use.

Dextrose 5% in Water (D_5W). Instillation D_5W for uterine distension is achieved by connecting a plastic bag containing 500 mL of the medium to one inflow channel of the sheath. The bag is wrapped with a blood pressure cuff inflated to 80 to 120 mm Hg. This system allows the fluid to run freely to the uterine cavity independent of need for control by the surgeon. Approximately 250 mL is used in 15 minutes, which is the maximum time needed for diagnostic hysteroscopy. This medium is particularly safe as it is rapidly absorbed from the peritoneal cavity. The major disadvantage is that D_5W does not allow for operative hysteroscopy, since bleeding will obscure vision. Since D_5W tends to flow freely through the tubal ostia and from the cervix, intrauterine pressure may not exceed 50 mm Hg; pressure of 100 to 110 mm Hg is required to visualize the tubal ostia and to obtain adequate diagnosis. Because of these drawbacks, the author does not recommend the use of this distending medium for either diagnostic or operative hysteroscopy.

CO_2 Gas Insufflation. Although the visualization achieved with CO_2 distension is excellent, the author warns against its use. Sophisticated instrumentation is needed for careful control of its delivery into the uterine cavity. There is always the possibility of gas intravasation with secondary hypercarbia, possible acidosis, and cardiac arrhythmias. Troublesome gas bubbles may form and obscure the view if there is fluid or mucus in the uterine cavity. CO_2 gas intrauterine insufflation is not suitable for operative hysteroscopy since bleeding rapidly becomes a hindrance.

Indications

Hysteroscopy is indicated in any situation where intrauterine visualization is essential for proper diagnosis of intrauterine pathology or when intrauterine hysteroscopic procedures are feasible. Table 3-1 lists the commonly accepted indications for hysteroscopy.

TABLE 3-1. Indications for Hysteroscopy

1. Proper identification of intrauterine filling defects diagnosed by hysterosalpingogram such as synechiae, polyps, myomas, or foreign bodies.
2. Evaluation of the intrauterine cavity in cases of reproductive failure manifested by infertility or recurrent abortion.
3. Evaluation of recurrent abnormal uterine bleeding.
4. Location and retrieval of intrauterine foreign bodies.
5. Lysis of intrauterine adhesions.
6. Resection of intrauterine polyps or myomas.
7. Transcervical incision of uterine septa.
8. Investigation of cervical and uterine neoplasms (contact hysteroscopy).
9. Embryoscopy (contact hysteroscopy).

Contraindications of Hysteroscopy

Patients with recent or currently existing pelvic inflammatory disease should not undergo hysteroscopy since the procedure may exacerbate the infection. Also, hysteroscopy is difficult when heavy uterine bleeding is present and usually fails to localize the source of bleeding under these circumstances. Dilatation and curettage (D&C) is often a more appropriate diagnostic and therapeutic approach to the problem. If indicated, hysteroscopy can be done a few days post D&C when bleeding has already ceased or minimized. Except for embryoscopy by the contact hysteroscope, hysteroscopic examination should not be performed in patients who are or suspected to be pregnant. Disruption of the pregnancy may occur. Hysteroscopy is also contraindicated when there is a cervical or uterine malignancy. In selected cases a contact hysteroscopic examination can be useful in staging adenocarcinoma of the endometrium.

The Technique

Because panoramic hysteroscopy is the most commonly utilized of all the hysteroscopic techniques, contact and microcolpohysteroscopy will not be discussed. The panoramic technique can be used for any of the indications mentioned before with the exception of endometrial cancer staging.

A preoperative history and a complete physical examination are essential to rule out any contraindications to the procedure, particularly early pregnancy. All types of diagnostic hysteroscopy can be performed in the office under the combination of systemic analgesia and a paracervical block whereas operative hysteroscopy should be in the operating room under general anesthesia.

The panoramic view of the intrauterine cavity is best obtained if the procedure is performed during the follicular phase. However, with experience one can do the examination any time during the menstrual cycle; we do not recommend the procedure during menses to avoid the theoretical risk of producing endometriosis or carrying endometrial debris into the peritoneal cavity.

The patient is put in the dorsolithotomy position, a bimanual examination is performed, the urinary bladder is catheterized, then she is prepped and draped in the usual manner. Anesthesia must be general unless it is known in advance that the procedure will be a brief diagnostic one. In this case, 50 to 75 mg meperidine (Demerol) given intravenously followed by a paracervical block utilizing 10 mL of 1% lidocaine hydrochloride on each side. Five to 10 minutes are allowed for the anesthetic to take effect. During this time the instrument is assembled and the operator prepares for the hysteroscopic procedure.

With the obturator in the sheath's main channel and with a tube connected to one of the sheath's side channel, Hyskon is injected slowly to expel all the air from around the obturator prior to its insertion into the cervical canal. Air bubbles may be difficult to expel once they are introduced into the uterine cavity; their presence is troublesome and may obscure a large portion of the intrauterine cavity. When cervical dilatation is necessary, it should not exceed 8 mm to avoid leakage of the distending medium from around the sheath. After the endocervical canal and the uterine cavity are sounded, the sheath with the obturator in place is introduced to a level just beyond the internal cervical os. The obturator is then removed and the telescope is introduced and fixed in the encasing sheath. Extra care should be taken at this time in handling the instrument to avoid pulling it out of the uterine cavity or advancing it too far, causing perforation of the uterus. The best way to keep the assembled instrument at the desired level is to hold it between the thumb and index fingers, with the fifth finger and the adjacent area of the hand resting against the patient's buttock. At the start the assistant injects 5 cc of Hyskon to distend the uterine cavity, followed at intervals with 2 to 3 cc to maintain adequate intrauterine pressure for any diagnostic or operative procedure. If there is bleeding or excess cervical mucus, it can be easily washed out by normal saline irrigation, allowing its escape through the opposite irrigating channel.

Once the uterine cavity is adequately distended, a systematic exploration is performed. The fundus is first examined, then the anterior, posterior, and lateral walls are scrutinized. Both tubal ostia should be identified; their recognition may be enhanced by increasing the intrauterine fluid pressure and observing the flow patterns of the Hyskon. While the hysteroscope is being withdrawn at the completion of the procedure, the cervical canal is thoroughly scanned. If laparoscopy is to be performed concurrently, we prefer to explore the pelvic cavity first, perform any operative laparoscopic procedures, and leave the laparoscope in place for simultaneous observation with both endoscopes should need arise during hysteroscopy. Findings are recorded on a special form that can be designed according to the operator's need. As an immediate postoperative follow-up, the patient is observed for any bleeding, major discomfort, or temperature elevation. A minor discomfort can be treated with mild analgesics and spotting is ignored as it is normal following hysteroscopy.

Diagnostic and Operative Applications of Hysteroscopy

Abnormal Uterine Bleeding

To be able to appreciate the abnormal, one must fully understand the normal. The appearance of the endometrium when panoramic hysteroscopy is employed varies with the different phases of the menstrual cycle. In the proliferative phase the endometrium is short, thin, pink, or tan and has few blood vessels. Under the Hyskon pressure the endometrium flattens and becomes pale. Secretory endometrium is tall, thick, and shaggy; it is velvety to touch and pink or tan in color. Small submucosal blood vessels may be sporadically seen.

Hysteroscopy proved to be valuable in determining the cause of chronic uterine spotting or bleeding and in clarifying questionable findings based on hysterosalpingography.[8]

Abnormal uterine bleeding constitutes the most common indication for any type of hysteroscopy. The rate at which intrauterine pathology is detected when panoramic hysteroscopy is employed to investigate abnormal bleeding may reach up to 85%.[10] Findings included polyps, submucosal myomata, endometrial hyperplasia, foreign bodies, and in perimenopausal patients, endometrial carcinoma. Extra care must be taken to differentiate polyps from the thick endometrium of the luteal phase. The polyp has a rounded, smooth free end, whereas thick strips of endometrium have a shredded appearance and can be easily dislodged by a gentle stroke with the end of the hysteroscope. Myomata can be easily distinguished from polyps, as the latter have gentle undulations as the pressure of the distending medium varies (Fig. 3-1).

Hysteroscopy establishes not only the correct diagnosis for abnormal uterine bleeding, but direct visualization ensures complete removal of the lesion. Gribb,[3] performing hysteroscopy after D&C, observed the failure of curettage to completely empty the uterine cavity. Small polyps can be pulled out during hysteroscopy by catching the base with a special grasping forceps. Larger ones can be curetted by a special hysteroscopic curette under vision or by using the conventional curette directed blindly at the exact location. Immediate hysteroscopic reexamination is essential to confirm the adequacy of the procedure.

Small penduculated or sessile submucous fibroids can be easily pulled out by Overstreet polyp forceps directed at the location of the fibroid after

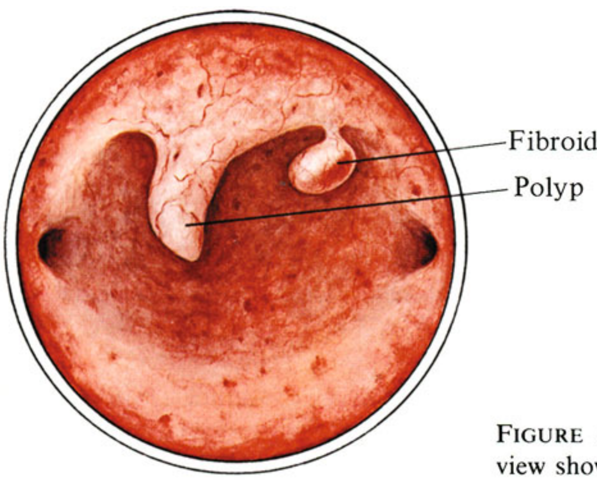


FIGURE 3-1. Panoramic hysteroscopic view showing a polyp and a fibroid.

the withdrawal of the hysteroscope. Larger fibroids may be successfully removed using a modified resectoscope.[7] All intrauterine manipulations, particularly when an electrocautery is being employed, must be monitored by concomitant laparoscopy. Postoperative bleeding can be controlled by use of a Foley catheter inserted into the uterus to accomplish uterine tamponade.[4] The balloon of a No. 8 catheter is distended with 5 to 10 mL of fluid until the bleeding stops. Larger uteri may need up to 20 mL or even 30 mL when bleeding is relatively excessive. The balloon is left in place for 24 hours. Antibiotic coverage for such patients would be appropriate.

Infertility and Recurrent Pregnancy Loss

Hysterosalpingography (HSG) is mandatory in the evaluation of infertility and recurrent pregnancy loss. When an intrauterine abnormality is detected, it is obvious that the nature of the lesion should be identified by direct visualization and dealt with by operative hysteroscopy. If HSG fails to demonstrate any intrauterine abnormality, then hysteroscopy becomes a controversial issue. The author believes that after a complete infertility workup and when no apparent cause is found, laproscopic combined with hysteroscopic examination is essential for the completion of the investigation. The yield of the combined approach in patients with unexplained infertility is high.[11] The lesions most commonly seen in infertile patients were polyps, myomata, synechiae, and septa. The significance of these lesions on infertility is not yet clear, as few obvious cause and effect relationships have been demonstrated.

By the same token, when no clear cause is found for recurrent pregnancy loss, hysteroscopic examination should be the final step to rule out the possibility of intrauterine pathology.

Intrauterine Foreign Bodies

Hysteroscopy has offered an effective approach to the management of lost foreign bodies in the uterus. Lost intrauterine devices (IUD) and broken tips of a plastic suction curette can be easily retrieved. The procedure can be performed under local anesthesia as an office procedure. Extensive manipulation is rarely needed as localization of the foreign body is usually immediate and accurate. Removal is effected by a hysteroscopic grasping forceps or by removing the telescope and introducing a distally hinged alligator forceps.

Lysis of Intrauterine Adhesions

We were able to confirm Hamou's observation that one can distinguish three types of intrauterine adhesions by their surface appearance: endometrial, myofibrous, and connective tissue.[5] The endometrial type resembles endometrium and can be easily broken up by the hysteroscope. The myofibrous adhesions can be treated by simple pressure with the hysteroscope but usually need to be severed by scissors; the muscular element is rarely the source of troublesome bleeding. The connective tissue type is the most severe and it can be lysed only with sharp scissors; bleeding, if any, is usually minimal (Fig. 3-2). Excellent visualization under high intrauterine pressure with Hyskon is the key to a successful procedure. Bleeding spots can be eliminated by increasing the intrauterine pressure. It is a good practice to withdraw the scissors when you encounter any bleeding to evaluate the site and the extent of the problem. When the operator approaches the fundus, he may find it necessary to use a curette instead of scissors to avoid uterine perforation. Lysis of adhesions

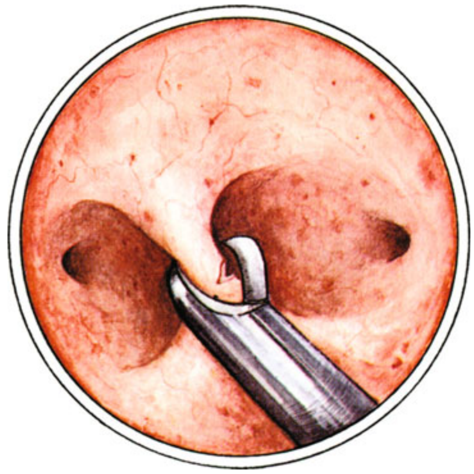


FIGURE 3-2. Panoramic hysteroscopic view showing intrauterine synechiae being cut.

under direct vision is preferred to the traumatizing effect of the curette. General anesthesia is essential for all intrauterine operative procedures. Concomitant laparoscopy is recommended but not mandatory. Postoperatively a No. 8 Foley catheter with a 5-mL bulb is used to separate the uterine walls for five days. An IUD will not serve any purpose and its use should be condemned. Broad spectrum antibiotics are given only if a catheter is inserted into the uterine cavity or if a complication such as uterine perforation arises. Conjugated estrogen (Premarin) 2.5 mg is given twice daily for 20 days followed by medroxyprogesterone acetate (Provera) 10 mg/day for seven days. HSG is performed after the second menses to evaluate the results of surgery and advise the patient.

Complete lysis of adhesions under direct visualization can be achieved in the great majority of women. Among women who have no other cause for their infertility, 75% conceived and a term pregnancy rate of as high as 90% was achieved.[6]

Excision of Uterine Septum

The septate uterus is a potential cause of reproductive failure in some women. It accounts for a small number of patients with infertility, recurrent abortion, or premature delivery. Hysterosalpingography does not differentiate between a septate or a bicornuate uterus. Laparoscopy enables the operator to evaluate the external configuration of the uterus and a normal fundus, for a double uterus indicates that an intrauterine septum exists. Previous surgical correction has been by abdominal metroplasty with the use of Strassmann's, Jones', or Tompkin's procedures. With increased experience in operative hysteroscopy, endoscopists succeeded in excising the uterine septum via the hysteroscope (Fig. 3-3).[2] Hysteroscopic metroplasty is not applicable to the true bicornuate uterus whose fundus has an abnormal external configuration, as this type of mullerian abnormality requires an abdominal approach.

Concomitant laparoscopy is mandatory as it allows the operator to document a normal external uterine contour and monitor the hysteroscopic procedure. After the hysteroscope is introduced into the uterine cavity and when visualization of the anatomy is adequate, miniature scissors are used to excise the septum. Excision should be carefully and systematically performed, beginning at the lowest part of the septum. The incision should be at an equal distance from the anterior and posterior uterine walls, allowing the incised septum to retract into the uterine walls. Bleeding from small vessels can be handled

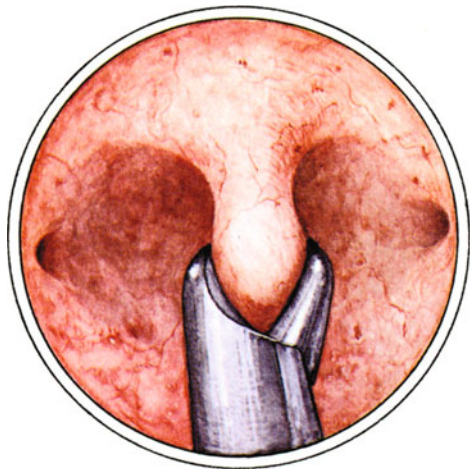


FIGURE 3-3. Panoramic hysteroscopic view showing the uterine septum being incised by the scissors.

by increasing the Hyskon intrauterine pressure; we have never used electrocautery to stop these bleeders. After complete septum resection, hysteroscopy should show a normal uterine cavity with both tubal ostia visualized at the same time. No intrauterine devices are needed postoperatively, nor is estrogen treatment necessary. Broad spectrum antibiotics are only indicated if uterine perforation occurs. Hysterosalpingography is performed after the second menses to evaluate the results of surgery.

Hysteroscopic resection of the uterine septum requires significant experience with hysteroscopy but if properly done, it has several advantages over the conventional abdominal approach. It has less perioperative and postoperative morbidity, and it eliminates the possibility of postoperative pelvic adhesions; since the uterine wall was not transected, vaginal delivery can be safely utilized.

Complications

Properly performed, hysteroscopy should be a low-risk procedure with minimal complications. The most serious risks of hysteroscopy are related to general anesthesia or to the distension medium. Anesthetic complications are not different from those of other surgical procedures using general anesthesia. Hyskon intravasation may occur but is rare and is usually of little consequence. CO_2 insufflation, if properly monitored, should cause no problems. Rupture of a hydrosalpinx due to pressure generated by the distension medium has been reported.[9]

Uterine perforation is a real risk during operative hysteroscopy. Very rapid flow of the Hyskon with no uterine distension should raise the suspicion that a uterine defect has been created. Perforation can be minimized if the hysteroscope is introduced and advanced under direct vision.

Uterine bleeding during diagnostic hysteroscopy should never occur, but operative procedures may occasionally be associated with bleeding from small vessels. No treatment is required; rarely a Foley catheter balloon is used as a tamponade. Thermal injuries from the use of electrocautery for coagulation of small bleeders have been reported.[7] Postoperative infection has been reported but we never encountered any.

Conclusion

Hysteroscopy has proved to be a useful diagnostic and operative technique. It offers promise as a investigative tool for hysteroscopic sterilization, tubaloscopy, and embryoscopy. The role of the microcolpohysteroscope in the assessment of carcinoma of the endometrium appears to be forthcoming.

References

1. Barbot J, Parent B, Doerler B: Hysteroscopic de contact et cancer de l'endometre. *Acta Endoscopia* 1978; 8:17.
2. Dal DC, Walters CA, Soto-Albors CE, et al: Hysteroscopic metroplasty: Surgical technique and obstetric outcome. *Fertil Steril* 1983; 39:623–628.
3. Gribb JJ: Hysteroscopy, an aid in gynecologic diagnosis. *Obstet Gynecol* 1960; 15:593–601.
4. Goldrath MH: Uterine tamponade for the control of acute uterine bleeding. *Am J Obstet Gynecol* 1983; 147:869–872.
5. Hamou J: *Microhysteroscopie: Mises a Jour College Francais Gynecol. Obstet.*, Paris, Vigot Press, 1981.
6. March CM, Israel R, March AD: Hysteroscopic management of intrauterine adhesions. *Fertil Steril* 1981; 36:455–459.
7. Neuwirth RS: A new technique for an additional experience with hysteroscopic resection of submucous fibroids. *Am J Obstet Gynecol* 1978; 131:91–94.
8. Norment WB: The hysteroscope. *Am J Obstet Gynecol* 1956; 71:426–432.
9. Siegler AM, Kemman E: Hysteroscopy. *Obstet Gynecol Surv* 1975; 30:567–588.
10. Sugimoto O: *Diagnostic and Therapeutic Hysteroscopy.* New York, Igaku-Shoin Medical Publishers, 1978.
11. Taylor PJ, Leader A, George RE: Combined Laparoscopy and Hysteroscopy in the Investigation of Infertility, in Siegler AM, Lindemann HJ, (eds): *Hysteroscopy: Principles and Practice.* Philadelphia, JB Lippincott Co, 1983, pp 207–210.

Vaginal Surgery

II

Wound Healing in Gynecologic Surgery

4

Gynecologists, like all surgeons, perform essentially three functions in surgical procedures: they incise tissue, perform some observation or task, and repair the wound created. The alterations in tissue incised, the changes produced by the implantation of foreign bodies such as prosthesis or suture material, and the response as the wound heals have been given little attention in the gynecologic literature. Our colleagues in the fields of plastic and general surgery have made monumental contributions to our understanding of these processes. Gynecologic surgeons should be conversant with the more recent literature, particularly the work of Doctors Hiram C. Polk, Thomas K. Hunt, Erle E. Peacock, and Walton Van Winkle. The following section draws heavily from these authors and their contributions to the art and science of surgery are appreciated.

Response to Injury

Inflammatory Phase

Whether one enters the patient with a single stroke of the sharp knife, with a scissor wound in the performance of an episiotomy, or through the insertion of the trocar in laparoscopy, the initial basic response to injury is the same and is called the inflammatory or substrate phase of wound healing. The magnitude of the inflammatory response varies in proportion to the trauma inflicted, being least with a knife, intermediate in a scissor wound, and greatest with blunt dissection. The addition of cautery, laser, constant rubbing of the wound, traumatic clamping of tissue, and excess suture material all greatly accentuate the injury.

The initial response to incision is the release of blood from small vessels in the area. The vessels immediately respond with vasoconstriction; this vasoconstrictive period lasts for approximately 10 minutes. It is followed by general vasodilation of the area vessels. The cellular response begins immediately and leukocytes adhere to the endothelium of vessels in the area of injury. Within one hour the entire endothelium is covered with adherent polymorphonuclear leukocytes, erythrocytes, and platelets. Active rouleaux formation plugs the small capillaries and further obstructs blood flow. Leakage of fluid also occurs directly between endothelial cells of the vessels, and the surgeon notices this as a clear serum bathing the wound edges. White blood cells actively migrate to the wound in approximately the same concentration as in the plasma. It would appear that the predominance of mononuclear cells found later in the wound is due to the shorter life of polymorphonuclear leukocytes. Immediate control of microorganisms in the wound is the sole function of the polymorphonuclear leukocytes, and in their absence, infection-induced neutropenia has no affect on wound healing.[16] A hemostatic response occurs simultaneously with the vascular response, and the plasma kinin system produces a local cycle of increased permeability. More platelets and fibrin are laid down, with the formation of blood clots.

Numerous substances are active in the vascular and inflammatory responses to the initial incision. Histamine, serotonin, kinins, and various chemotactic agents all play an active role. An additional group of substances quite active in the response to injury are prostaglandins E_1 and E_2. They have strong vasodilative and lymph-flow-increasing properties and play a prominent role as mediators of the acute inflammatory process. Note that certain drugs, among them aspirin, are potent inhibitors of prostaglandin synthesis.[14]

Secondary Phase

The initial phase of wound healing lasts from the time of the incision to the fourth day. During the later portion of this substrate phase, the cellular infiltrates into the area of the wound include polymorphonuclear leukocytes, lymphocytes, macrophages, and monocytes. Mast cells are present and are a source of heparin and a variety of enzymes. Remember that no wound strength is present during the early repair process, but a weak gel-like substrate of enzymes, fibrin, and white cells fills the space produced by the wound. Reexploration in the intermediate postoperative period therefore has little retardant effect on wound healing as no collagen strands linking the wound edges are present. Epithelium grows from both the wound edges and the bases of hair follicles if any adnexal structures remain in the wound.

Fibroblastic or Proliferative Phase

This phase of wound healing occurs during days 5 to 20. The key element during this phase is the fibroblast. Although debated for many years, it appears from the work of Grillo and Potsaid that most fibroblasts arise locally.[7] This evidence was obtained by the use of the inhibitory effects of irradiation on fibroblasts. Design and repair of an incision in irradiated fields must accommodate the changes in the healing process, which are caused by irradiation, or serious wound complications will arise.[7]

Fibroblasts actively synthesize collagen, which provides for the strength of the repair. Mucopolysaccharides are secreted as well, which may contribute to fibril orientation and proliferation.

The observation that the fibroblasts arise locally places great emphasis on the need for gentle wound construction and repair. These fibroblasts use the fibrin strands as scaffolding and begin to elaborate fibrous collagen precursor into the wound. Capillaries follow with fibroblasts, and new capillary formation is prominent. Capillaries are formed by endothelial budding and contain a plasminogen activator that produces fibrinolysis, and the fibrin net is removed. The wound is actively invaded with capillaries and fibroblasts. There is new evidence to suggest that platelets, previously thought important only in coagulation, stimulate fibroblastic proliferation through synthesis of growth factors.[16]

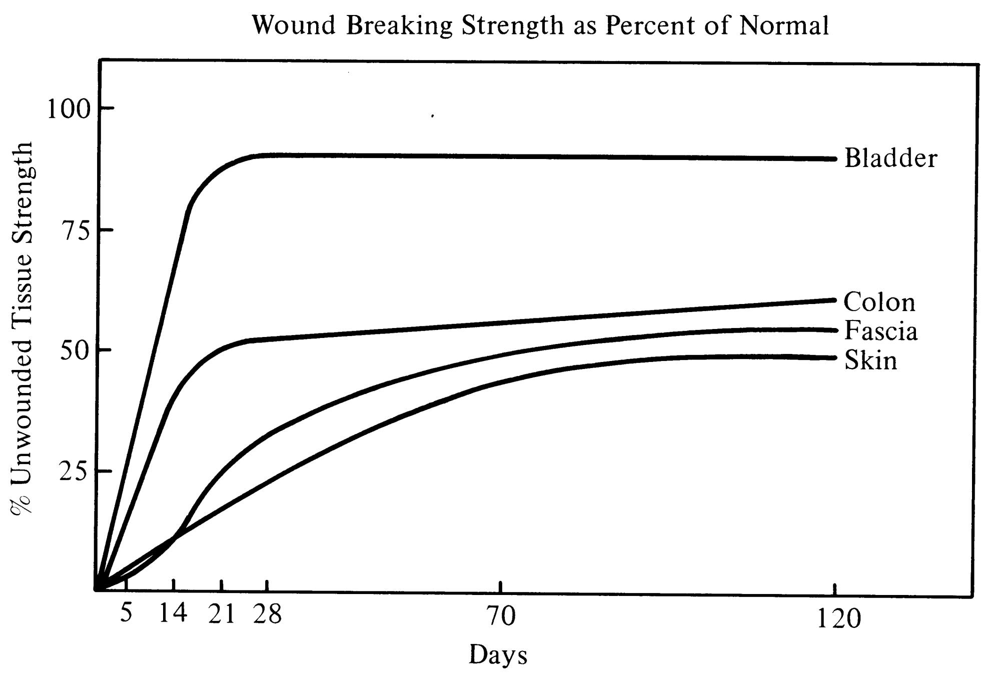


FIGURE 4-1. Wound breaking strength as percent of normal (Adapted from Van Winkle W, Salthouse TN.[20])

Collagen fibrils are laid down and cross-linkages occur which produce the rapidly increasing tensile strength of the wound. By the end of the 21st day, the wound has regained approximately 30% of its original tensile strength, a figure equal to the percentage provided by nonabsorbable sutures (Fig. 4-1).

It is important to note that the wider scar is weaker than the narrow one. The ideal wound is a wound with normal tissues approximated by minimal new connective tissue formation.

Although there are numerous studies of adhesion formation, it would appear that the most consistent producer of adhesions between the viscus and the abdominal wall is tissue injury and its resultant release of tissue fluids. Promethazine, dexamethasone, and oxyphenbutazone have been tried with varying degrees of effectiveness but with little clear-cut clinical success.[9] A recent collaborative study found that using intraperitoneal dextran 70 was effective in reducing the formation of postoperative adhesions following distal tubal surgery.[1] There is no evidence that closure of either pelvic or parietal peritoneum diminishes adhesion formation and may indeed promote it where tissues are compressed with sutures and are anoxic.

Remodeling Phase

The final phase of wound healing is particularly active in the buttock, abdominal wall, and back. Wound healing, then, is a process of protein synthesis subject to numerous modifying factors. Vitamin C deficiency, protein starvation, cortisone and nitrogen mustard administration, and irradiation have been shown to have retarding effects on wound healing. Diabetics with blood sugars of over 200 mg/dL have improperly functioning white cells and are deficient in inflammatory response to wounds.[6] The clinical consequences of this improper response are well known to any experienced clinician. Edema and anoxia also have deleterious effects. Local infection severely disrupts the healing process and occurs when the number of bacteria exceeds the injured tissue's ability to deal with the bacterial population in the wound. The usual gynecologic patient does not suffer from malnutrition or protein deficiencies severe enough to retard healing. Cortisone usage is much less common in gynecologic patients than in, for example, patients with inflammatory diseases of the bowel. Experimentally, the combined treatment with estrogen and progesterone has been shown to significantly retard the development of granulation tissue by adversely affecting the initial inflammatory reaction.[2] The elevated levels of these hormones in pregnancy may help explain the high infectious morbidity associated with cesarean section. Anemia severe enough to produce anoxia is rare in clinical practice today, and congestive failure is usually detected and treated prior to surgery.

The most common retardant of repair in gynecologic surgery is injury from poor tissue handling; antiquated instruments; excessively sized, chemically reactive strangulating sutures; and poorly designed surgical procedures that fail to adhere to sound surgical practices based on modern wound repair data. The resultant trauma increases the infection rate, delays wound healing, and promotes formation of a weaker scar.

Prophylactic antibiotics, clearly indicated in certain surgical procedures, are not to be considered a substitute for proper technique. When used, antibiotics are most effective when present in cells and tissue fluids of the wound at the time of injury.

The procedures, instruments, suture selection, and pre- and postoperative recommendations presented in this manual are chosen and designed to interfere least with wound healing. As the surgeon can do little to accelerate wound healing, he can ill afford to retard its normal progression.

Suture

Suture Materials

As surgical skills and techniques advance, suture selections become more important. Suture technology has not produced a perfect suture material but progress is being made. The ideal characteristics of nonreactivity, properly timed complete absorption, high tensile strength, and proper handling characteristics are not now available in any single suture material; therefore, the surgeon must be familiar with several suture types.

New suture materials are derived from polyglycolic acid (Dexon, Vicryl), polyamides (nylon), polyesters (Dacron), polyolifins (Prolene), and polydioxanone (PDS). With textile technology advances, handling characteristics of these synthetic materials have improved. Gut, cotton, and silk, which have served surgeons and their patients so well for so many years, have become less attractive.

Suture material is generally classified as absorbable and nonabsorbable in type. The term *nonabsorbable* suggests permanence and continued strength, but this is not necessarily the case. The filaments of 2–0 braided black silk, a nonabsorbable suture, are widely separated by fibroblasts 21 days after surgical implantation, and only 50% of the original strength of the suture remains at 50 days. Braided polyester, however, has little loss of tensile strength or fibril absorption after 1 year in tissue[20] (Fig. 4-2).

Clinical practice requires not only proper material selection but correct choice of suture size as well. Tensile strengths of five unknotted suture materials in 4 gauges are listed in Fig. 4-3.

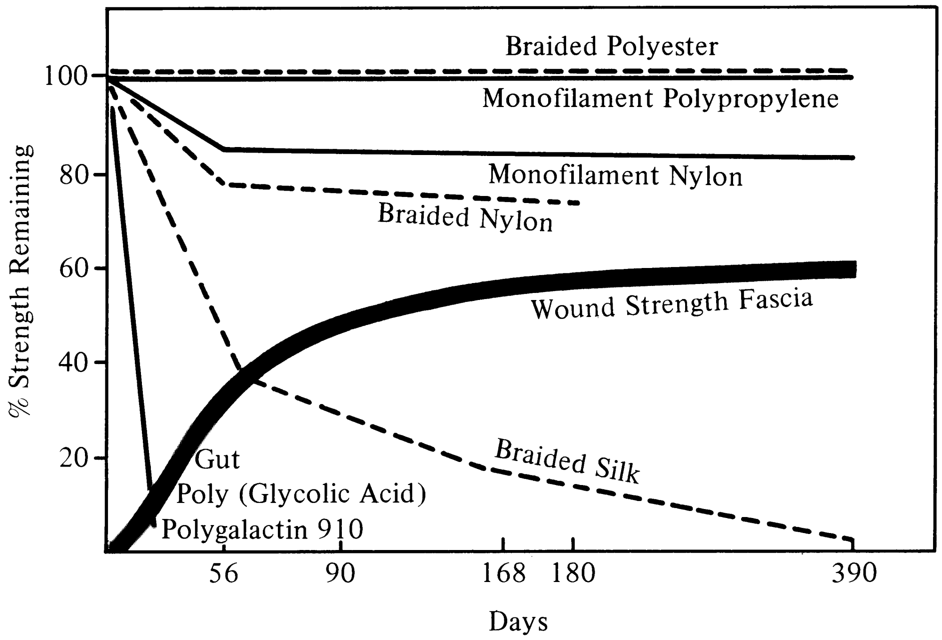


FIGURE 4-2. The strength remaining in suture material plotted against time and days is seen above. Note the relative stability in wounds closed with Dacron and polypropylene. (Adapted from Van Winkle W, Salthouse TN[20]).

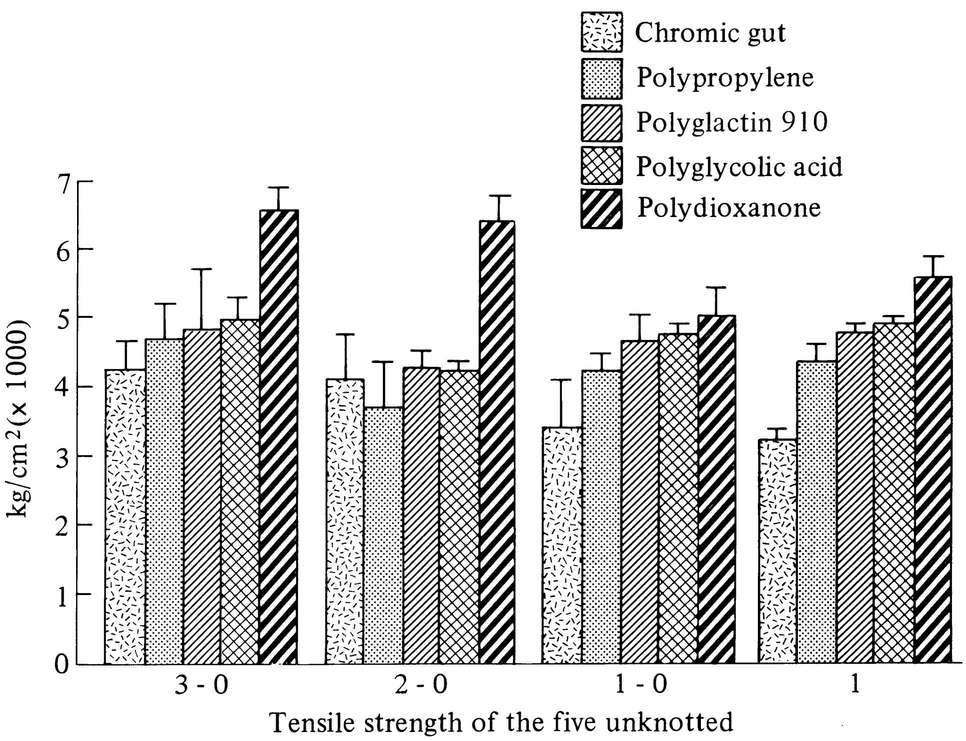


FIGURE 4-3. Tensile strength of five unknotted suture materials in four gauges.

It makes little sense to use sutures markedly stronger than the tissues in which they are placed (Table 4-1); hence, the large gut sutures (Nos. 0, 1, and 2) historically used in gynecologic surgery have little justification when tissue strength, knot-pulled breaking strength, and modern wound data are reviewed. The increasing quality, consistency, and strength of synthetic sutures make possible the use of smaller diameter suture material; 3-0 absorbable suture has 40% less volume than 2–0 and 2–0 suture, 36% less than 0[10]; 2–0 polygalactin 910 is approximately as strong as 0 chromic, permitting its substitution and a reduction in the volume of suture material left in the wound.

Table 4-1. Pull-Out Strengths in Tissues

Tissue	Strength (lb)
Fat	0.44
Peritoneum	1.9
Muscle	2.8
Fascia	8.3

Adapted from Van Winkle W, Hastings JC: *Surg Gynecol Obstet* **135**:113–126, 1972.

Cutting the suture close to the knot also reduces the amount of suture material placed in the wound. Synthetics may require a 3-mm ear for knot stability.

Suture Selection

Specific suture selection for each procedure is noted in each chapter, but some generalizations are possible.

Retention sutures should be monofilament nylon or polyester for patient comfort and nonreactivity. To convince oneself of the variation in wound response to suture, the surgeon need only place a retention suture of large-diameter silk alongside one of monofilament nylon or polyester. Before the sutures are removed, a wide area of inflammatory response will be present around the silk suture, but little response will be noted with the monofilament suture. Monofilament polypropylene sutures require numerous knots. This does produce some mass of suture material, but it is negligible as the knot is outside the tissues. The ends of such large sutures can be irritating to the patient; however, the suture ends may be pulled into a cut portion of catheter. Place through-and-through retention sutures carefully so as to avoid the anastomosis between the superior and inferior epigastric arteries. Retention sutures placed through and through give great wound security. Kobak observed that Kennedy reported more than 30,000 wounds without a dehiscence using retention sutures.[10] However, retention sutures have a tendency to cut through skin and have largely been replaced by Smead-Jones type sutures for most midline closures.

The use of absorbable sutures in midline abdominal wound closure would seem unwise after review of Fig. 4-2; however, good to excellent results have been reported.[3,4] Zero or 2–0 Prolene suture (Ethicon) placed in Smead-Jones fashion is the author's choice for midline incision closure. Postlethwait reported that nylon causes the least tissue reaction.[15] Although Van Winkle and Salthouse noted no increase in experimental infections when braided nylon was compared with monofilament nylon,[20] the author's surgical experience has not substantiated this observation.

Concern with the loss of tensile strength at 21 days when using polyglycolic acid and polyglactin 910 has prompted approximately 10% of pelvic surgeons to use permanent material for closure of midline fascial incisions.[8] The recent introduction of polydioxanone, an absorbable monofilament, offers an alternative material with significantly greater tensile strength at 28 days than either polyglycolic acid or polyglactin 910. Skin clips are widely used and produce the same cosmetic appearance and a time saving of 80%.[13]

A wound closure is only as strong as the tissues in which the suture is placed; hence, wide bites of tissue should be included in the outer arm of the Smead-Jones closure. A good rule of thumb is to place the sutures as far apart as they are from the wound edge. The intent of the suture (i.e. apposition while fibroblastic proliferation is effecting wound healing) should not be compromised with excessively taunt sutures that create local hypoxia. Stone et al demonstrated significantly lower wound tensile strengths with tight suture closure[19] (Fig. 4-4).

Sutures placed in the Smead-Jones fashion are stronger than any other common closure technique. Larsen and Ulin measured the mean tensile strength of artificial wounds closed with 3–0 polyester in kilograms.[11] With the sutures placed in strong material, Smead-Jones closure failed at 39 kg and was two to three times as strong as the other types of closure. Continuous sutures failed at 18 kg, and the single interrupted stitch at 22 kg.

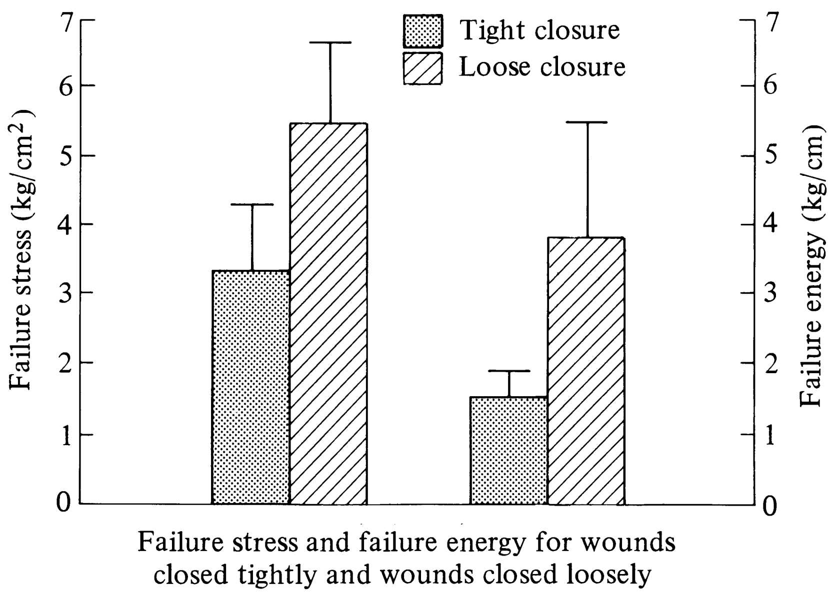


FIGURE 4-4. Failure stress and failure energy for wounds closed tightly and wounds closed loosely.

It is impossible to discuss suture material without discussing knots. A suture with acceptable unknotted strength will be useless if the knot efficiency approaches 5% when the harried surgeon using 3–0 polyglycolic acid places a 1 × 1 (granny) knot instead of the more secure 1 = 1 (square) knot with a knot efficiency of 58%. An extra throw for a 1 = 1 = 1 knot results in 85% knot efficiency. Stone et al reported knot stability for coated polyglycolic acid and coated polyglactin 910 using a 2 = 1 = 1 = 1 configuration (Fig. 4-5).[17] For polydioxanone the 1 = 1 = 1 = 1 configuration achieves maximum tensile strength with minimum failure by slippage.[18]

Transverse wounds of the abdomen of the Pfannenstiel type have significant inherent strength and may be closed with a smaller suture. Continuous absorbable suture of 2–0 diameter is adequate for this fascial closure. If the patient has a transverse incision through all layers, use nonabsorbable sutures of 2–0 polydioxanone. If a fine cosmetic scar is desired, close the transverse incision with 3–0 subcuticular monofilament polypropylene or nylon; 4–0 polyglycolic acid without dye may be used, and although tissue reaction is slightly greater, patients appreciate that no suture need be removed. The choice of transverse incision with a subcuticular closure and a few 5–0 or 6–0 monofilament nylon sutures to even ridges produced by the subcuticular suture provides good cosmetic results. Bracing the wound margins with Steri-strips or collodian dressing will diminish stress on the wound edge, which will decrease scar width.

Use 2–0 absorbable suture for ovarian arteries and uterine arteries and 2–0 or 3–0 absorbable suture for the vaginal cuff and cardinal ligaments. The use of very fine absorbable suture to close the vaginal cuff in vaginal and abdominal hysterectomy will greatly diminish the reaction noticed in the paravaginal tissues postoperatively. It does little good, however, to use a very fine suture if large traumatic needles are used. Carefully chosen fine-diameter intestinal needles produce much less trauma to tissues and are useful in performing gynecologic surgical procedures.

It is important to observe that although some suture materials and configurations of sutures are much less prone to be associated with infection than others, all suture materials increase wound infection rate experimentally. The author does not close the subcutaneous tissues for this reason.

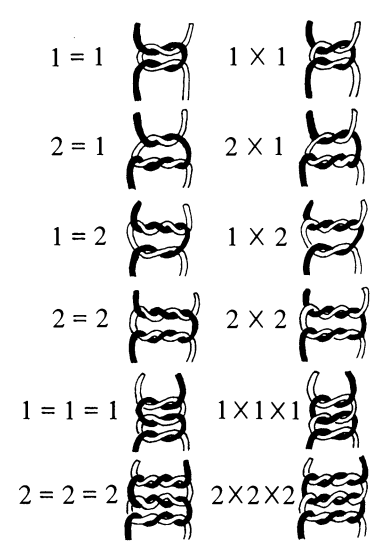


FIGURE 4-5. Twelve-knot configurations using international nomenclature adapted from Tera H, Åberg C: *Acta Chir Scand* 142:1–7, 1976.

Bacteria can be recovered from the majority of surgical wounds, but the number of bacteria must exceed 10^6 per gram of tissue for clinical evidence of infection with most bacteria. If silk material is added to the experimental wound, 10^3 organisms per gram will regularly produce clinical infection.[5] Close wounds with the minimum amount of the least reactive suture consistent with hemostasis, operative intent, and anatomic closure.

Surgical Instruments

The modern surgical hemostat dates from the work of Dr. Ambroise Pare in the mid 1500s. Surgical instruments became more traumatic in gynecologic surgery and reached their acme with the angiothryptor of Kossman. The maximum compressive force available was sought and great tissue destruction was produced. The lack of blood, the absence of antibiotics, and the lethal nature of any infection acquired in surgery seemed to justify these forces. Modern wound healing data make it abundantly clear that the wound with the least trauma, dead tissue, and suture material has the most resistance to infection. This wound heals with greater strength than the wound that contains tissues compressed by surgical instruments of excessive force. The purpose of gynecologic surgical forceps is not the compression of tissues, but rather traction to increase exposure and to mobilize tissues into the field.

Select artery forceps of very fine construction with sharp points and a gentle pelvic curve. Adson or Gemini artery forceps 8 inches in length serve admirably for this purpose, and eight pairs should be available for pelvic surgical procedures. The jaws produce little trauma, the instrument is large enough such that it is not easily misplaced at the time of laparotomy, and its curved end is useful in suture passage.

The author has designed clamps for the parametria, vagina, paracolpium, pelvic arteries, and veins. The Masterson clamp* has nontraumatic teeth that sit in a jaw with minimal lateral motion, a strong box lock, and multiple wide-travel ratchets. This instrument produces minimal jaw pressure with effective tissue fixation and is available in 8½- and 10-inch lengths with straight, curved, and right-angle jaw configurations. Heaney and Kocher clamps all produce excessive pressure in the tissues clamped with no greater purchase for traction. The trauma produced is remarkable when studied in the surgical laboratory.[12] Figure 4-6 illustrates relative pressures measured in the jaws of some of the clamps described.

Thumb forceps with serrated jaws should be available in short, medium, and long lengths (see Fig. 4-7). Adson-Brown forceps provide excellent traction with minimal tissue trauma. Never grasp needles with thumb forceps as this destroys the teeth. When suturing, grasp tissues to be sutured with thumb forceps and curve the needle gently through the tissue; do not release the tissues by the thumb forceps. A common mistake of the fledgling surgeon is to release the tissues as soon as the needle has passed and grasp for the needle with the thumb forceps. This both destroys the thumb forceps and unnecessarily traumatizes tissues that are to be joined. The original purchase should remain in the thumb forceps and the needle holder should be returned to the position of function with the palm down, grasping the needle in the opposite tissues and completing the arc. If the thumb forceps are not removed, the needle will remain quite stationary in the tissue sutured and can be easily grabbed.

* Codman and Shurtleff, Inc., Randolph, Mass.

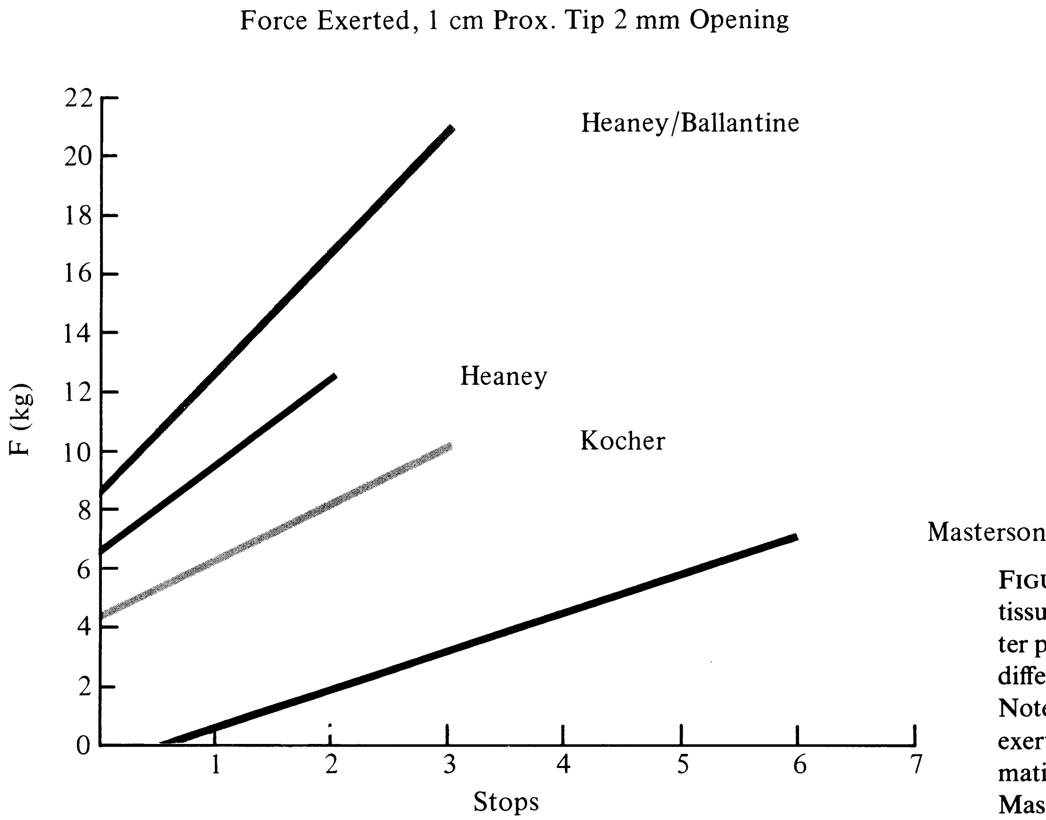


FIGURE 4-6. Force exerted on tissues measured at one entimeter proximal from the tip of four different clamps is seen above. Note the tremendous pressures exerted on tissues when traumatic clamps are closed. (From Masterson et al.[12]).

When reconstructive procedures are performed deep in the pelvis, very narrow long thumb forceps, such as the Debakey thumb forceps, are useful.

Dissection should be sharp wherever possible and knife handles of varying lengths are needed. The use of the knife handle as a dissector instead of the blade is a misuse of the instrument.

Fine dissecting scissors are a vital tool in pelvic surgery (Fig. 4-7). The author prefers the short, fine-bladed, slightly rounded Metzenbaum scissors or Nelson chest scissors of delicate construction. Purchase excellent scissors and guard them from the less skilled surgeon. Use these scissors for dissection and not for cutting vaginal or thick portions of tissue; have strongly constructed scissors for these purposes in both long and very long (12-inch) lengths.

Have needle holders available in short, medium, and long lengths (Fig. 4-8). Very long delicate needle holders are needed for ureteral anastomosis. Jaw strength should be sufficient for holding both very fine and medium-length needles. Avoid the use of very large needles in the pelvis, but occasionally a general closure needle is needed deep in the pelvis, and the jaws should be sufficient to handle this without springing. The surgeon may palm the needle holder without closing for more rapid suturing.

Hemostatic clip appliers of medium and long lengths are employed in pelvic surgery, and at least three pairs are necessary with sufficient clips to complete the procedures anticipated (Fig. 4-9).

The key to pelvic surgery is exposure. The pelvis restricts mobility because of the rigid, bony formation, and the proper retractors are most important in pelvic surgery (Fig. 4-10).

Equally as important is a complete set of instruments for the very obese patient with a very deep pelvis. The Balfour retractors with very large deep blades are invaluable, as are at least two very long needle holders, thumb forceps, scissors, and artery forceps.

Glassman bowel forceps are useful, as are lightly constructed rubber-shod clamps. A complete list of these and other instruments is provided in the Appendix.

Finally, an auxiliary light source is a necessity for surgery in the deep recesses of the pelvis. A flexible fiberoptic cable light with a sterile transparent sleeve that slips over it is very functional in abdominal procedures, and a weighted speculum that transmits both light and suction is most useful in vaginal procedures.

Appendix: Instrument List

Vaginal Surgery

Scissors
- 2 — 7″ Metzenbaum (delicate) curved
- 1 — 9″ Metzenbaum (delicate) curved
- 1 — 6¾″ Mayo curved
- 1 — Suture

FIGURE 4-7. Thumb forceps and scissors.

Thumb forceps
- 2 — 4¾″, 6¼″, 8″ Adson-Brown
- 2 — 8″, 1 × 2 teeth

Needle holders
- 2 — 6″, 7″ Crile Wood (delicate)
- 2 — 7″ Mayo Hegar
- 1 — 9″ Julian

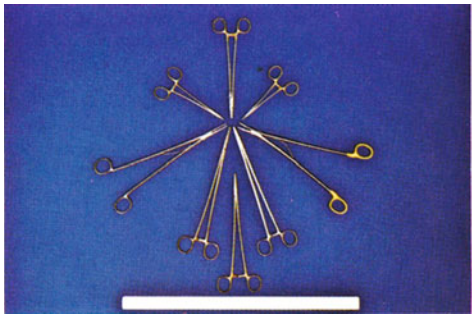


FIGURE 4-8. Needle holders.

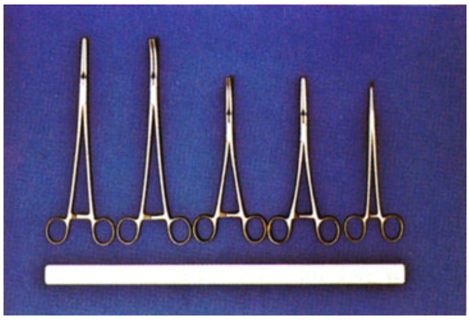


FIGURE 4-9. Hemostatic clamps and hemostatic clip appliers.

Clamps
- 3 — 6¼″ Lahey thyroid tenaculum
- 6 — 6¼″ Allis adair
- 4 — 8″ Masterson curved
- 4 — 8″ Masterson straight
- 8 — 6¼″ Crile curved
- 4 — 5½″ Crile straight
- 2 — 8″ Allis
- 4 — 8″ Gemini

Other
- Schubert uterine biopsy forceps
- Pratt uterine dilatator and curette
- Sponge forceps
- Uterine sounds
- Knife handle
- Basin
- Towel clips
- Neuro, pool, and tonsil suction tips
- Marking pen
- Fiberoptic light source
- Bipolar coagulator

Retractors
- 1 — Weighted vaginal speculum 1¾″ × 3″, 1¾ × 4″
- 3 — Deaver 1″ × 9″
- 1 — Sims vaginal retractor

Abdominal Surgery
Scissors
1 — 5½″ flat
2 — 7″ Metzenbaum (delicate) curved
2 — 9″, 11″ Nelson (delicate) curved
1 — 10″, 11″ Metzenbaum (delicate) curved
1 — 9″, 14″ heavy curved dissection
1 — 4¾″ wire cutter
1 — Potts cardiovascular right angle
1 — Suture

Thumb forceps
2 — 4¾″, 6¼″, 8″ Adson-Brown
2 — 9½″ Debakey
2 — 8″, 1 × 2 teeth

Needle Holders
2 — 6″, 7″ Crile Wood (narrow jaw)
1 — 8¼″, 9″ Julian
2 — 9″, 10″ Wagenstein
1 — 10½″ Masson (delicate)

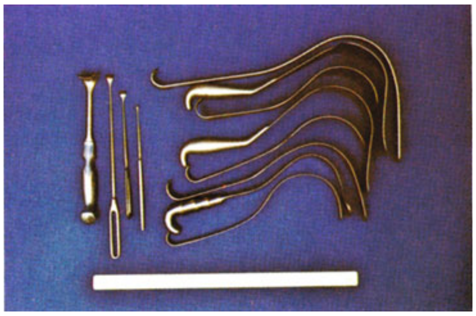


FIGURE 4-10. Retractors.

Clamps
4 — 5¼″ Crile straight
16 — 6¼″ curved delicate
16 — 5″ mosquito
8 — 8″ Gemini or Adson
4 — 8½″ Masterson straight
2 — 8½″ Masterson curved
4 — 10½″ Masterson straight
2 — 10½″ Masterson curved
4 — Sarot intrathoracic
2 — Glassman intestinal
2 — 8″ Allis and Babcock
2 — Hemostatic clip appliers medium and large

Retractors
3 — Double-hook skin tenaculum
1 — Balfour regular with shallow and deep blades, extra large
2 — Richardson small, medium, large
3 — Deaver 1″ × 12″
3 — Deaver 1½″ × 12″
3 — Deaver 3″ × 12″
1 — Deaver 3″ × 12″ × 7½″
1 — Deaver 5″ × 13″ × 7½″
2 — Deaver 1″ × 16″
2 — Harrington 2″ × 12″
1 — Harrington 2½″ × 12″
1 — Harrington 3¼″ × 10″
2 — Crushing vein retractor

Other
Sponge forceps
Knife holders
Basins
Towel clips
Neuro, pool, and tonsil suction tips
Marking pen
Fiberoptic abdominal light source
Bipolar coagulator

References

1. Adhesion Study Group. Reduction of postoperative pelvic adhesions with intraperitoneal 32% dextran 70: A prospective, randomized clinical trial. *Fertil Steril* 1983; 40:612–619.
2. Ahonen J, Jiborn H, Zederfeldt B: Hormone influence on wound healing, in Hunt TK (ed): *Wound Healing and Wound Infection: Theory and Surgical Practice.* New York, Appleton-Century-Crofts, 1980, pp 99–105.
3. Baggish MS, Lee WK: Abdominal wound disruption. *Obstet Gynecol* 1975; 46:530–534.
4. Corman ML, Veidenheimer MC, Coller JA: Controlled clinical trial of three suture materials for abdominal wall closure after bowel operations. *Am J Surg* 1981; 141:510–513.
5. Elek SD, Conen PE: The virulence of *Staphylococcus pyogenes* for man. A study of the problems of wound infection. *Br J Exp Pathol* 1957; 38:573–586.
6. Goodson WH III, Radolf J, Hunt TK: Wound healing and diabetes, in Hunt TK (ed): *Wound Healing and Wound Infection: Theory and Surgical Practice.* New York, Appleton-Century-Crofts, 1980, pp 106–116.

7. Grillo HC, Potsaid MS: Studies in wound healing. IV. Retardation of contraction by local x-irradiation, and observations relating to the origin of fibroblasts in repair. *Ann Surg* 1961; 154:741–750.
8. Hartko WJ, Ghanekar G, Kemmann E: Suture materials currently used in obstetric-gynecologic surgery in the United States: A questionnaire survey. *Obstet Gynecol* 1982; 59:241–246.
9. Holtz G: Prevention of postoperative adhesions. *J Reprod Med* 1980; 24:141–146.
10. Kobak MW: *Studies on the Abdominal Incision.* Springfield, Ill, Thomas, 1965.
11. Larsen JS, Ulin AW: Tensile strength advantage of the far-and-near suture technique. *Surg Gynecol Obstet* 1970; 131:123–124.
12. Masterson BJ, Sullivan TG, Townsend P: Development of a noncrushing clamp for gynecology surgery. *Am J Obstet Gynecol* 1978; 132:113–117.
13. Meiring L, Cilliers K, Barry R, Nel CJC: A comparison of a disposable skin stapler and nylon sutures for wound closure. *S Afr Med J* 1982; 62:371–372.
14. Peacock EE, Van Winkle W: Healing and repair of viscera, in *Wound Repair,* Philadelphia, Saunders, 1976, ch 12.
15. Postlethwait RW: Long-term comparative study of nonabsorbable sutures. *Ann Surg* 1970; 171:892–898.
16. Ross R: Inflammation, cell proliferation, and connective tissue formation in wound repair, in Hunt TK (ed): *Wound Healing and Wound Infection: Theory and Surgical Practice.* New York, Appleton-Century-Crofts, 1980, pp 1–10.
17. Stone IK, von Fraunhofer JA, Masterson BJ: Mechanical properties of coated absorbable multifilament suture materials. Accepted for publication.
18. Stone IK, von Fraunhofer JA, Masterson BJ: Polydioxanone: Knot stability and tensile strength, *in vivo* and *in vitro.* Accepted for publication.
19. Stone IK, von Fraunhofer JA, Masterson BJ: The biomechanical effects of tight suture closure on fascia. Accepted for publication.
20. Van Winkle W, Salthouse TN: Biological response to sutures and principles of suture selection. Somerville, NJ, Ethicon, 1976.

Selected Bibliography

Hunt TK: *Wound Healing and Wound Infection: Theory and Surgical Practice.* New York, Appleton-Century-Crofts, 1980.

Peacock EE Jr: *Wound Repair.* 3 ed. Philadelphia, Saunders, 1984.

Preoperative Evaluation, Preparation, and Estimate of Operative Risk

5

Javier F. Magrina

This chapter reviews guidelines for estimating operative risk, along with the preoperative evaluation of healthy patients and those with cardiac and pulmonary disease, the preoperative preparation of patients with pulmonary disease (pulmonary prep), and those undergoing bowel resection (bowel prep).

Estimation of Operative Risk

Operative (or surgical) risk is defined as the probability of morbidity or mortality from preoperative preparation, anesthesia, the operation, and the postoperative period for 42 days following the surgery. Each patient probably has a different surgical risk, and although general management guidelines are helpful, individualized preoperative evaluation and preparation provide optimal results.

In a review of 26,127 gynecologic surgeries at the Mayo Clinic,[45] the overall death rate was 0.2%. Among patients with malignant disease it was 1.1% and for patients with benign disease 0.07%. Table 5-1 shows the death rate for different gynecologic and general surgical procedures. Among the various gynecologic procedures, no significant differences of death rate were appreciable, with the exception of a lower rate for those undergoing dilatation and curettage and vulvectomy and a higher rate for patients having exenteration. Although adnexal surgery had a relatively high death rate, it may be because all patients who died postoperatively had malignant disease, the majority with metastatic breast cancer or ovarian carcinoma.

The general and specific causes of death are listed in Tables 5-2 and 5-3, respectively. The leading causes of death in gynecologic surgery patients by order of frequency were cardiovascular complications (37%), respiratory complications (14%), nonpulmonary infections (14%), renal failure (14%), hemorrhage (8%), hepatic (malignant) (8%), endocrine (3%), and carcinomatosis (2%). Among cardiovascular complications, congestive heart failure, myocardial infarction, and cerebrovascular accidents accounted for the deaths. Respiratory complications resulting in death included pneumonia, respiratory failure, and pulmonary emboli. Peritonitis and enteritis were responsible for the infection-related deaths. All patients dying of renal causes had renal failure. This study, as others, indicated that common complications that cause surgical deaths are cardiovascular and respiratory in origin. The patient's poor condition may explain the similarity in the percentage of deaths attributable to

TABLE 5-1. Death Rate for Gynecologic and General Surgical Procedures

Procedures	Death Rate (%)
Hysterectomy	
Abdominal	0.3
Vaginal	0.1
Radical	0.8
Adnexal surgery	0.7
Myomectomy	0.3
Vulvectomy	0.0
Conization	0.2
D&C	0.01
Exenteration	3.8
Tonsillectomy	0.06
Appendectomy	0.13
Cholecystectomy	0.3
Inguinal hernia repair	0.11

Adapted from Robbins and Mushlin[29] and Williams and Pratt.[45]

TABLE 5-2. General Causes of Death in Gynecologic Surgery Patients

Cause	%
Cardiovascular	37
Respiratory	14
Infection (nonrespiratory)	14
Renal	14
Hemorrhage	8
Hepatic	8
Endocrine	3
Carcinomatosis	2

Adapted from Williams and Pratt.[45]

respiratory, infectious, and renal causes. Those who died from infections had cancer, trauma, resection of the intestinal tract, or bowel perforation (ulcer or postradiation). Six out of eight who died from renal failure had cancer, and three had undergone exenterations.

As to the time of occurrence, complications leading to operative morbidity and mortality in surgical patients in general can be grouped as preoperative; perioperative: (a) induction of anesthesia, (b) intraoperative, (c) first 48 hours postoperatively; and postoperative until 42 days after the operation.

Preoperative morbidity and mortality are complications arising from the evaluation and preparation of patients for surgery. Preoperative radiologic procedures may cause complications. Anaphylactic reactions and renal failure have been associated with intravenous pylegrams. Barium enemas have resulted in rectal perforation and complete obstruction. Patients subjected to bowel prep may experience decreased vitamin K, resulting in prolonged prothrombin time and increased bleeding, and secondary enteritis from an overgrowth of bowel organisms. The two most common offending organisms are *Candida*

TABLE 5-3. Specific Causes of Death in Gynecologic Surgery Patients

Origin	Type
Cardiovascular	Cerebrovascular accident
	Congestive heart failure
	Myocardial infarction
Respiratory	Pulmonary embolism
	Respiratory failure
	Pneumonia
Infection	Peritonitis
	Enteritis
Renal	Failure
Hemorrhage	
Endocrine	Pituitary failure
Hepatic	Metastases

Adapted from Williams and Pratt.[45]

albicans and *Staphylococcus aureus.* Pulmonary procedures such as aerosol therapy may result in acute lower airway obstruction in a patient with partial airway obstruction from retained secretions. Aerosol particles can also precipitate bronchospasm, or pulmonary infection may result from contaminated equipment. Complications can even occur from preoperative procedures to help patients to withstand surgery such as thoracenthesis, paracenthesis, central venous lines, and Swan-Ganz catheter.

The perioperative period includes induction of anesthesia, intraoperative, and postoperative period for the first 48 hours. The perioperative death rate has been estimated at 0.3%.[10] Of all the perioperative deaths, induction of anesthesia accounts for 10%, intraoperative deaths for 35%, and postoperative deaths during the first 48 hours, for 55%.

It has been estimated that of the anesthetic deaths (induction and intraoperative), 85% are due to errors in management.[7] Intraoperatively, the surgeon can be responsible for direct mortality or compound the anesthetic deaths by technical errors, hemorrhage, and complications that directly result from excessively long or extensive procedures in high-risk patients.

Feigal and Blaidsell[10] in their review of seven studies over a 19-year period reported the following primary causes of death during the first 48 postoperative hours:

a. Respiratory complications. Respiratory complications resulting in death included failure to maintain adequate ventilation and aspiration of gastric contents. Each accounted for 10% to 15% of all deaths within the first 48 hours postoperatively.

b. Cardiovascular complications. Arrhythmias, hypotension, and drug-induced myocardial depression each accounted for 10% to 15% of all deaths within the first 48 hours postoperatively.

In the National Halothane Study (1959–1962)[4] the overall death rate within 6 weeks of surgery was 2.8% in the 35 institutions involved. The common causes of postoperative death during this time were:

a. Pulmonary complications. The most common pulmonary complications were a consequence of a progressive series of pulmonary events consisting of hypoventilation, atelectasis, and pneumonia. This is estimated to occur in 20% to 40% of all postsurgical patients.[10] In older patients, the postoperative mortality associated with pneumonia has been reported to exceed 50%.[10]

b. Cardiac complications. The causes of death from cardiac complications during the postoperative period included congestive heart failure, myocardial infarction, acute pulmonary edema, and arrhythmia, each accounting for a similar percentage of deaths.

c. Infections. With the exclusion of pulmonary infections, peritonitis and sepsis accounted for an important percentage of postoperative deaths.

Other causes, each accounting for about 5% of postoperative deaths, included pulmonary embolism, renal failure, cerebrovascular accident, hemorrhage, and an inoperable or irreversible disease such as cancer.

Classification of Patients for Surgical Risk

There is the potential for complications and death with any surgical procedure on any patient. However, the possibility of complications and death is variable from person to person and depends on many factors: age, weight, medical condition, type of operation, and type and length of anesthesia.[25] However, a gross estimation of the surgical risk can be made by following the classification of surgical risk established by the American Society of Anesthesiologists (ASA) (Table 5-4).

TABLE 5-4. Classification of Patients for Surgical Risk (ASA Physical Status Scale)

Class I	A normally healthy individual.
Class II	A patient with mild systemic disease.
Class III	A patient with moderate systemic disease that is not incapacitating.
Class IV	A patient with incapacitating systemic disease that is a constant threat to life.
Class V	A moribund patient who is not expected to survive 24 hours with or without operation.
Class E	Added to any class patient with emergency surgery.

This classification is based on the physical condition of the patient, and many of the other factors that contribute to surgical risk are not considered.[25] However, studies[12] reviewing its effectiveness have indicated that it is the most accurate available scale in predicting noncardiac deaths. It is considered only a fair scale in predicting cardiac deaths.[12] In the National Halothane Study,[4] the overall percentage of postoperative mortality was 2.8%. For Class I it was 0.18%; Class II, 1.4%; Class III, 5.4%; Class IV, 12.4%; and Class V, 27.3%. When the degree of risk for an elective surgery was taken into consideration (low, medium, or high risk), the risk for Class V was 1,400 times greater than for low-risk Class I patients. The risk in any class is approximately double when emergency surgery is performed.[10]

Preoperative Evaluation of the Healthy Patient

Approximately 50% of the surgical procedures in this country are done on persons in good clinical condition whose only abnormality will be corrected by the operation.[29] These are Class I patients, according to the ASA scale. In the National Halothane Study,[4] the surgical mortality among these patients was only 0.18%. Preoperative evaluation is designed to identify unrecognized systemic conditions on presumably healthy patients. By doing so, a number of surgical complications and deaths may be prevented. In addition, there are clinical conditions that may not modify the surgical outcome but whose detection may benefit the patient. Anemia and ischemic heart disease are examples of these previously undetected conditions that may modify the surgical outcome. Previously unrecognized conditions that do not alter the surgical outcome but where early detection does benefit the patient include pregnancy and urinary tract infections. The number of asymptomatic patients with systemic conditions that can be recognized by screening is low.[29] The prevalence of asymptomatic conditions that affect the surgical outcome or where discovery is beneficial to the patient is listed in Table 5-5.

The most important parts of the preoperative evaluation in Class I patients are the history and physical examination. A detailed history and a careful, thorough physical examination are helpful in recognizing a number of clinical conditions previously unknown to the patient. Assuming the patient's history and physical examination showed no abnormalities, what type of laboratory tests would be most helpful to improve the surgical outcome? The sensitivity (false negative) and specificity (false positive) of a laboratory test affect the number of asymptomatic conditions detected. In addition, the asymptomatic prevalence of a condition can affect the usefulness of a laboratory test. The sensitivity and specificity of laboratory tests in detecting a number of asymptomatic conditions are given in Table 5-6.

TABLE 5-5. Estimated Prevalence of Asymptomatic Medical Conditions Per 1,000 Population

Condition	Estimated Prevalence per 1,000 (Asymptomatic)
UTI	14
Pregnancy	11
Anemia	10
Ischemic heart disease	5
Cardiac arrhythmias	5
Diabetes	2.9
Gonorrhea (female)	2.5
COPD	1.9
Syphilis, tuberculosis	0.4
Glaucoma, hepatitis	0.2
Other (chronic nephritis, clotting disorders, interstitial pulmonary disease)	0.01–0.3

Adapted from Robbins and Mushlin.[29]
UTI, urinary tract infection; COPD, chronic obstructive pulmonary disease.

For the surgical evaluation of asymptomatic persons, a complete history and physical examination are mandatory. Those with abnormal physical findings are no longer in Class I and should be evaluated appropriately. In the remainder, the following laboratory tests are recommended: for all patients—hematocrit, urinalysis, and pregnancy test; for selected patients—SGOT, creatinine, serum glucose, ECG, and purified protein derivative (PPD) for tuberculosis screening.[29]

TABLE 5-6. Sensitivity and Specificity of Tests to Detect a Number of Asymptomatic Conditions in Healthy Individuals

Condition	Estimated Asymptomatic Prevalence (per 1,000)	Test	False − %	False + %
UTI	14	Urine culture	5	16
Pregnancy	11	Pregnancy test	2	1
Anemia	10	Hematocrit	0	0
Ischemic heart disease	5	ECG	73	19
		Stress test	36	9
Diabetes	2.9	2-hr PP glucose	24	44
Gonorrhea (female)	2.5	Cervical culture	4	0
COPD	1.9	Spirometry	0	0
Tuberculosis	0.4	PPD	10	15
Chronic nephritis	0.3	Creatinine	0	0
Hepatitis	0.2	SGOT	0	50
Glaucoma	0.2	Tonometry	39	22
Thrombocytopenia	0.05	Platelet count	0	0
Clotting disorders, chronic	0.01	PTT	1	28

Adapted from Robbins and Mushlin.[29]
UTI, urinary tract infection; COPD, chronic obstructive pulmonary disease; PPD, purified protein derivative; PTT, partial thromboplastin time.

The hematocrit and pregnancy test have high sensitivity, specificity, low cost, and provide information of immediate importance to the surgical patient. Urinalysis, as well, is appropriate because impaired renal function alters drug metabolism and hence the patient's response to anesthetic drugs. The sensitivity of urinalysis is less but its low cost makes it generally applicable.[29]

Among the tests that are valuable for selected patients, SGOT not only helps the patient but, because of the transmission risk of hepatitis, also benefits the personnel who come into direct contact with the patient or her blood products. Serum creatinine is an accurate reflection of renal function, and because numerous drugs are excreted by the kidneys, "optimal medical management is unlikely in the absence of this information."[29] Patients with undetected diabetes probably would be recognized and treated during careful postoperative care. Preoperative serum glucose is beneficial if the operation would not be done on a diabetic patient. ECG may be useful in detecting previously silent myocardial infarctions and conduction defects. It also may recognize arrhythmia not significant enough to be detected by physical examination. It is of low sensitivity and specificity for the detection of asymptomatic ischemic heart disease and thus is of questionable value there.

The routine ordering of chest x-rays and partial thromboplastin time (PTT) in preoperative patients cannot be justified on the basis of available data. The National Center for Devices and Radiological Health of the Federal Drug Administration recently assessed the efficacy of chest x-ray screening programs. Recommendations included the discontinuation of routine screening examinations for unselected populations and of routine chest radiograms for hospital admission.[8] This was based on the observation that "the yield of unsuspected disease (e.g., lung cancer, heart disease, and tuberculosis) found by routine screening chest x-ray examinations of unselected populations not based on history, physical examination, or specific diagnostic testing has been shown to be of sufficient clinical value to justify the monetary cost, added radiation exposure, and subject inconvenience of the examination."[8]

A previous study,[30] likewise, failed to demonstrate any value in the PTT for those at no increased risk of clotting disorders. The theoretical cost for diagnosing a single case was estimated at $1 million. This can be compared with the theoretical cost of $400 and $1,300 for a single detected case of anemia and pregnancy, respectively.[31]

Preoperative Evaluation of Patients With Heart Disease

The main goal of the preoperative evaluation of patients with cardiac disturbances is to determine the reserve capability of the heart to withstand the changes imposed by the operation and anesthesia. A careful plan for the improvement of heart function and prevention and recognition of complications is then outlined. The metabolic and hemodynamic changes that occur with the operation and anesthesia result in alterations of the myocardial metabolism. In addition, myocardial depression and induction of arrhythmias result from the administration of anesthetic.[31] Alterations of myocardial metabolism usually result from an increased oxygen demand or, more commonly, a decreased oxygen supply.[31] Among causes responsible for the former are tachycardia, fever, hypertension, and fluid overload; causes responsible for the latter are hypoxia, hypotension, anemia, hypovolemia, and bradycardia.[31] Enough cardiac reserve must be available to withstand these alterations without significant cardiac complications.

The risk of significant cardiac complications in healthy patients is low.

However, this risk is much higher in patients with preexisting cardiac disturbances and in those who are debilitated.

Risk of Cardiac Complications in Surgical Noncardiac Patients

Among the most common serious surgical cardiac complications are myocardial infarction, congestive heart failure with or without pulmonary edema, and arrhythmias.[13] The risk of myocardial infarction in patients without a history of cardiac disease has been estimated at about 0.13%,[39] with an associated mortality of approximately 25%.[23,41] This risk is evenly divided during the first five days following surgery.[23] The risk of congestive heart failure in patients with no previous history is estimated at 2%;[12] the risk of postoperative pulmonary edema is estimated at 2.5%, with an associated mortality of about 50%.[12,13] Approximately 10% to 16% of noncardiac patients develop intraoperative arrhythmias.[13,42]

Several studies have identified preoperative factors associated with increased surgical cardiac risk. Included are patients over 70, abdominal surgery, emergency operations, poor general medical condition, and reoperations.[12,13,31] In a prospective study,[12] patients with the following findings had a three to four times increased risk of cardiac complications and death: $PO_2 < 60$, $PCO_2 > 50$, potassium < 3, $HCO_3 < 20$ meq/L, BUN > 50, or creatinine > 3, increased SGOT, signs of chronic liver disease, or prolonged bed rest.

Risk of Cardiac Complications in Surgical Patients With Heart Disease

Heart disease commonly seen in gynecologic surgical patients include previous myocardial infarction, previous congestive heart failure, angina, arrhythmias, and valvular disease.

Preoperative evaluation of the gynecologic patient with heart disease includes history, physical examination, laboratory evaluation, and drug intake.

History. The patient's symptoms are most important since they provide an indication of the severity of cardiac impairment. A detailed questioning relative to dyspnea, orthopnea, chest pain, edema, nocturia, and syncope is necessary for choosing proper laboratory studies. A review of the patient's history of arrhythmias, myocardial infarction, congestive heart failure, pulmonary edema, and valvular disease is necessary for treatment planning and the perioperative evaluation of surgical risk. The patient's level of activities, her life style, and her ability to tolerate exercise are most important in evaluating the degree of cardiac disturbance. This information is used to classify the patient according to the criteria used by the New York Heart Association (1964) for persons with heart disease (Table 5-7).

Physical Examination. The physical examination also may provide an indication of the severity of cardiac impairment. Attention is given to signs suggestive of cardiac disorders. These include breathing pattern; blood pressure and pulse, indicating preexisting hypertensive disease and arrhythmias, respectively; pulmonary wheezes or rales over the lower lungs, suggestive of incipient pulmonary edema; jugular venous distention, indicating possibly elevated ventricular and diastolic pressure and suggesting congestive heart failure; S3 or S4 gallop, also suggestive of congestive heart failure; arrhythmias; a loud murmur (IV/

TABLE 5-7. Classification of Heart Disease According to the Criteria by the New York Heart Association

Class I	Heart disease; no symptoms
Class II	Comfortable at rest; symptoms with ordinary activity
Class III	Comfortable at rest; symptoms with minimal activity
Class IV	Symptoms at rest

Data from Criteria Committee of The New York Heart Association, Inc.: *Diseases of the Heart and Blood Vessels C Nomenclature and Criteria for Diagnosis (EDG)*. Boston, Little, Brown and Company, 1964.

VI), usually indicative of congestive heart failure and/or valvular disease; and the presence of dependent edema, suggestive of congestive heart failure.

Laboratory Evaluation. An ECG should be obtained and special attention given for arrhythmias, alterations of conduction, ischemic disease, evidence of hyptertensive heart disease, and other problems such as digitalis effect and electrolyte disturbances. The chest x-ray study is helpful in evaluating heart size and recognizing pulmonary edema. Blood gases are necessary to evaluate the degree of adequacy of the cardiopulmonary unit.

Drug Intake. Current and past cardiac drug therapy should be noted. As a rule, cardiac medications are continued throughout the pre- and postoperative course.[40] Prophylactic digoxin usually is used in the presence of atrial, arrhythmias, when there is a history of congestive heart failure, or in the presence of impaired ventricular function.[31]

Patients With Coronary Artery Disease

Previous Myocardial Infarction. Most myocardial infarctions or reinfarctions occur within the first five postoperative days,[39] so prophylactic measures should be extended throughout this time. The risk of reinfarction depends on the time since the previous infarction. Incidence of reinfarction is 38% if the surgery is performed within 3 months after the previous infarction, 15% if 3 to 6 months have elapsed, and 4% thereafter.[39] The mortality associated with reinfarction is in the range of 50% to 70%.[23,39,41]

Elective surgery should be postponed for at least 6 months after myocardial infarction.[13,39] If surgery is necessary to save the patient's life, some precautions are recommended, among them the use of sedatives and nitroglycerine for frequent angina and anxiety, intravenous propranolol to correct rapid increases of heart rate and blood pressure, nitroprusside for the control of hypertension, and possibly an intra-aortic balloon pump to improve coronary blood flow.[31]

Continuous ECG monitoring during and for five days after surgery is essential to detect silent infarctions and ischemic episodes. The use of a Swan-Ganz catheter and intra-arterial blood pressure measurements are helpful in more accurately monitoring responses to fluid therapy and cardiogenic drugs. Continuous surveillance is recommended in an intensive care unit where immediate therapy such as antiarrhythmic drugs is readily available. The feasibility of permanent pacemaker insertions also must be considered.[40]

Angina. Elective surgery should be postponed in patients with unstable angina. Surgery can be performed when the angina has been evaluated and stabilized medically or after coronary bypass surgery.[40] Stable angina does not appear to be a risk factor.[12] If surgery becomes necessary, similar prophylactic measures to those outlined for patients with previous myocardial infarction are applicable.

Patients With Arrhythmias

Patients with arrhythmias have an increased risk of cardiac complications and mortality. The risk of operative arrhythmias in those with preoperative arrhythmias is 27%.[42] The risk is 35% for patients with preoperative heart disease.[42] Cardiac arrhythmias must be evaluated and treated prior to surgery. Prophylactic digitalis is used for patients with atrial arrhythmias (paroxismal tachycardia, premature contraction, fibrillation) and premature ventricular contractions associated with cardiac dysfunction.[31] ECG monitoring is essential intra- and postoperatively. Intraoperative premature ventricular contractions and ventricular extrasystoles are relatively common and secondary to the release of catecholamines or respiratory insufficiency. They can be controlled by increasing the ventilatory rate, discontinuing stimulation, particularly bowel manipulation of the patient, decreasing anesthetic concentration, and discontinuing catecholamine administration.[31] Intravenous lidocaine or procainamide as a bolus may be required to terminate intra- or postoperative ventricular extrasystoles and may be followed by a continuous drip if necessary. Intraoperative tachycardia may be secondary to intra-abdominal manipulation, ocular pressure, or tracheal intubation that results in increased parasympathetic activity. Intravenous atropine may be required for its correction.[21]

Patients With Congestive Heart Failure

The operative risk of patients with heart disease is directly related to the degree of cardiac impairment. The risk of postoperative failure in those with Class I or II disease is not significantly increased. In contrast, the risk is high for patients in Class III or IV.[31] Patients with signs of congestive heart failure (jugular venous distention and/or S3 gallop) have a 14% operative risk for cardiac complications and a death rate of 20%.[21] The risk of postoperative heart failure in patients with no previous history is about 2%.[12] The risk of postoperative pulmonary edema is 2.5%, with an associated mortality of about 50%.[12] Prophylactic digoxin usually is given preoperatively to patients with a history of congestive heart failure. Surgery should be postponed in these patients, and the patient should have diuretics, digitalis, and vasodilators; electrolyte imbalances should be corrected prior to surgery. Measurements of intra-arterial blood pressure, left ventricular filling pressure, and cardiac output with a Swan-Ganz catheter are essential for monitoring intravenous fluids and the effect of vasoactive drugs.

Patients With Valvular Disease

Patients with valvular disease at risk for postoperative cardiac complications and death are those with a high degree of aortic stenosis (eightfold increased risk of cardiac death) and severe mitral insufficiency (ninefold and threefold increased risk of myocardial infarction and death, respectively).[12] Patients with severe valvular disease require open-heart corrective surgery prior to other surgery.[31] All patients with valvular disease and prosthetic valves should receive perioperative antibiotic prophylaxis to prevent bacterial endocarditis. The American Heart Association has established recommendations for bacterial endocarditis prophylaxis for patients undergoing genitourinary instrumentation and surgery.[6] Aqueous penicillin (2 million units IV or IM) or ampicillin (1 g IM or IV) is administered in conjunction with gentamicin (1.5 mg/kg or maximum of 80 mg IV or IM) or streptomycin (1 g IM) 30 minutes before the operation and twice postoperatively.

In patients with aortic prosthetic valves receiving anticoagulant therapy, discontinuing the therapy before the procedure and restarting it one to seven days following the operation does not increase the risk of thromboembolism.[40] Occasional thromboembolic episodes have been observed with this regimen in patients with mitral valve prosthesis.[20] In these patients it is recommended that oral anticoagulation be discontinued immediately before surgery, and intravenous heparin be given postoperatively until oral anticoagulants are restarted.[20]

Pulmonary Risks in Surgical Patients

Surgical Pulmonary Risks

Pulmonary complications are common during and after surgical procedures, with a reported prevalence ranging from 6% to 60%.[17] This risk is 23 times greater in patients with at least one abnormal pulmonary function test.[38] Respiratory complications are responsible for 14% to 25% of postoperative deaths.[27,45]

Factors responsible for respiratory complications in surgical patients include endotracheal intubation, anesthesia, muscular weakness, dehydration, pain, and restriction of physical activity.[36] These factors are responsible for physiologic changes in the lungs that promote the development of respiratory complications. Postoperatively, decreased vital capacity (VC) and 1-second forced expiratory volume (FEV_1) persist for several days.[24,25] In addition, mild oxygen desaturation, abnormal respiratory pattern with decreased or absent sigh breaths, and inadequate clearance of secretions also are observed.[18]

Pulmonary Physiology

A review of the normally operating pulmonary physiologic mechanisms is necessary to understand the pathophysiology of postoperative respiratory complications.

Under normal conditions the production of mucus and ciliary movement protect the lungs from particles and infective organisms. The trachea and bronchi are lined with a layer of mucus, which is produced by the respiratory cylindrical epithelium of the tracheobronchial tree. This layer of mucus is continuously mobilized toward the hilum of the lung and larynx by the forward motion of the respiratory cylindrical cells' cilia. From the larynx it is then moved into the pharynx and swallowed.[36] Normal mucus production and ciliary activity are present only in the absence of physiologic stress, pulmonary disease, and pulmonary insults.

Postoperative Pulmonary Changes

Anesthesia, positive-pressure ventilation, endotracheal intubation, high oxygen concentrations, and pulmonary insults such as smoking result in the depression of ciliary action. The end result is abnormal mucus flow, resulting in retained secretions. Local inflammation of the mucosa further compromises the bronchial lumen increasing resistance to air flow and respiratory work.[36] Consequently, the plugging of bronchioles and absorption-atelectasis of distal alveoli occurs, the result of which is ventilation-perfusion impairment. This contributes to the arterial hypoxemia that is commonly found in postoperative patients.[24] Stasis of secretions in atelectatic areas is an excellent culture medium for bacteria and may result in pneumonia. Mobilization of retained secretions is helpful in preventing and correcting this series of events.[38] Postoperatively, a 35% to 75% decrease of VC is observed.[24,35] Maximal reduction of the VC is seen 12 to 18 hours postoperatively, with gradual improvement until the third or fourth postoperative day when normal values are reached.[34] FEV, decreases to 35% of control values[24] further promoting abnormal ventilatory pattern.[18]

Pulmonary defense mechanisms, the most important of which is the cough, come into play in the presence of accumulated secretions.[37] Postoperatively, patients who have had abdominal surgery have severe impairment of the coughing mechanism and thus inadequate elimination of retained secretions. In healthy patients this usually is well tolerated. However, deterioration of normal defense mechanisms in patients with already compromised pulmonary function may lead to respiratory failure and/or associated cardiac problems as well. Preoperative preparation for those with pulmonary disease is directed to improving lung efficiency so that the patient may withstand the reduction of pulmonary function imposed by the operation and anesthesia.

Preoperative Evaluation of Patients to Prevent Pulmonary Complications

Preoperative evaluation of patients to prevent pulmonary complications includes a history, physical examination, chest x-ray study, ECG, pulmonary function tests, and arterial blood gases.

History. The respiratory history is the most important part of the initial evaluation of the surgical patient. Attention should be paid to whether the patient smokes, the presence of a productive cough (frequency and volume of sputum), wheezing, exercise tolerance, previous tolerance to anesthesia, previous respiratory problems, and the use of respiratory drugs. Age and weight are very important and directly related to respiratory complications. With advancing age, especially in patients over 60, there is less efficient respiratory function because of a decrease in elasticity and lung volumes. After 60 the risk of respiratory complications is increased threefold.[34] Obese patients have a twofold increased risk of respiratory complications and have impaired vital capacity[34]; patients who smoke have a fourfold increase of respiratory complications.[34] Smoking is responsible for decreased surfactant activity of the alveoli, which predisposes the patient to microatelectasis.[33] In addition, depression of the ciliary function of the respiratory epithelium and decreased alveoli macrophage activity are found,[33] both of which predispose patients to pulmonary infections. Smokers have been shown to have increased airway resistance and impairment of ventilator distribution, as well which also contribute to postoperative pulmonary complications.[33]

Physical Examination. Physical examination is directed to observation of the respiratory pattern, auscultation, and percussion of the lungs. The presence of rales, rhonchi, or wheezes may be indicative of an increased amount of secretions and, therefore, airway obstruction. Wheezing can best be detected during forced expiration, but auscultation of the lungs also should be performed during quiet breathing and forced inspiration. Percussion of the bases of the lungs during inspiration and expiration will indicate the excursion of the diaphragm.

Chest Radiogram. A chest radiogram is not very helpful in patients with obstructive lung disease. It is more helpful in those with restrictive lung disease such as pulmonary fibrosis and other pulmonary pathology such as fluid overload, atelectasis, and pleural effusion. Deviations of the trachea should be noted because they may contribute to difficult intubation.

Pulmonary Function Tests. Pulmonary function tests such as arterial blood gases and spirometry are indicated in patients with history of pulmonary disease, heavy smoking, cough, obesity, or if they are of advanced age.[10]

Preoperative Factors Increasing Pulmonary Complications

Increased pulmonary complications are observed in surgical patients with preoperative respiratory symptoms and signs such as dyspnea, orthopnea, productive cough, wheezing, obesity (twofold increased risk), aged over 65 (threefold increased risk),[34] previous postoperative respiratory complications, smoking (fourfold increased risk), preexisting acute or chronic pulmonary disease,[17] abnormal spontaneous ventilatory pattern, abdominal operation (fourfold increased risk), and abnormal pulmonary function tests (23 times the increased risk).[38]

Obstructive pulmonary disease is associated with a much higher incidence of postoperative complications than restrictive disease and carries a much worse prognosis for pulmonary complications and death.[38] Restrictive pulmonary disease, unless severe, is not associated with increased postoperative morbidity.[17,38] Expiratory flow rates are well preserved, allowing a good cough and the effective elimination of postoperative pulmonary secretions.[17] Obstructive pulmonary disease, such as asthma, bronchitis, and emphysema, carries a significant risk of postoperative pulmonary complications.[37] In patients with chronic bronchitis and emphysema, the incidence of postoperative atelectasis or pneumonia was 70% compared with 3% for patients with no obstructive disease.[38] In a separate study the incidence of postoperative pulmonary complications in asthmatic patients was 24%.[11]

Preoperative Laboratory Evaluation

Preoperative pulmonary laboratory evaluation should be performed in surgical patients with one or more of the previously outlined risk factors. Basic evaluation includes spirometry and arterial blood gases.

Spirometry. The two most basic and important measurements are the forced vital capacity (FVC) and the 1-second forced expiratory volume (FEV_1).

1. FVC. Vital capacity is the sum of the tidal volume plus the respiratory reserve volume. It is an indicator of the ventilatory reserve and represents the ability to maintain healthy lungs by being able to adequately ventilate and clear secretions.[3] The patient is instructed to take the deepest breath possible and then exhale the air as rapidly as possible. The volume of air exhaled is known as forced vital capacity (FVC). Normal vital capacity values

in healthy adults are between 55 and 85 mL/kg. For effective coughing and deep breathing to clear the lungs of secretions, a minimal vital capacity of 15 mL/kg (about 1 L for a 70-kg adult) is necessary.[35] A patient with a vital capacity less than 15 mL/kg will not be able to tolerate the changes imposed by the anesthesia and operation and is likely to retain secretions and develop atelectasis and pneumonia.

2. FEV_1. This is an indicator of significant airway resistance. For the measurement of the FEV_1, the patient is instructed to take a deep breath and then exhale as rapidly as possible. The volume of air exhaled during the first second is the FEV_1 (the measurement of all volume of air exhaled is the FVC). Healthy patients exhale almost the entire vital capacity in less than 1 second, and a patient must be able to exhale in less than 3 seconds to be able to tolerate the changes brought about by anesthesia and surgery. Normally, the FEV_1 is greater than 4 L and should be at least 2 L for elective surgery.[3] It is expressed as a percentage of the FVC and is normally 80% of FVC. An FEV_1 of less than 50% is indicative of airway resistance of such magnitude that significant reduction of ventilatory reserve is present.[35]

Arterial Blood Gases. Arterial PO_2 is an indicator of lung function; it provides information on blood oxygenation, the primary function of the lungs.[35] Arterial CO_2 is an indicator of severe lung disease[35] and the need for postoperative ventilatory assistance.[10] A mild degree of oxygen desaturation is noted postoperatively[24] and before surgery with increasing age. PO_2 decreases approximately 0.4 mm Hg per year after aged 20, and it will give a rough estimate of the PO_2 corrected by age.[35]

Prophylaxis of Postoperative Pulmonary Complications

The postoperative reduction of VC and FEV_1 causes patients to retain bronchial secretions. The postoperative absence of the normally occurring sigh breaths is associated with a gradual alveolar collapse.[24] The prevention of postoperative alveolar collapse by regular, periodic maximal inflation of alveoli has become an economical and simple way to prevent postoperative atelectasis and pneumonia. Incentive spirometry has been shown to be most effective in achieving this goal and in reducing postoperative pulmonary complications.[19] Reinforcement of the expiratory efforts such as with the use of blow bottles has not been shown to consistently reduce postoperative complications, and similar results have been obtained with the use of prophylactic intermittent positive pressure breathing (IPPB).[19] The benefit of using blow bottles is the inspiration immediately preceding the forced expiration. With the incentive spirometer, the patient is given an incentive (to move colored balls, turn on a light, or achieve a predetermined volume) to sustain the motion as long as possible. Studies have shown that inflated alveoli remain open for at least one hour after hyperventilation.[24] Therefore, hourly maximal inflations should provide optimal prevention of collapsed alveoli. Incentive spirometry is applicable to patients with a VC greater than 15 mL/kg.[36] Postoperative prophylactic IPPB is reserved for patients with a significant decrease of VC to less than 15 mL/kg.[36] These patients are unable by themselves to adequately inflate their lungs. Positive pressure inspirations are mechanically delivered to prevent alveolar collapse.

In patients with retained secretions, bronchial hygiene therapy (BHT) is indicated prior to surgery. BHT (pulmonary prep) is designed to clear the airway of retained secretions so that lung efficiency improves and the patient can tolerate the changes associated with anesthesia and surgery. The chief objective is to improve the ventilatory reserve to compensate for the postoperative decrease of VC.[16] BHT is indicated in patients with retained secretions. The need for BHT is dependent upon the inability to mobilize secretions, not on the degree of pulmonary disease,[36] and is usually carried out within 48 hours. Increased VC and FEV_1 often are noted at the completion of BHT.[36] A reduction of postoperative pulmonary complications has been observed by the perioperative use of BHT.[38]

Included in BHT are the discontinuation of smoking, an evaluation of sputum, the administration of mucolytics and bronchodilators, chest physical therapy, and the teaching of respiratory maneuvers.[16]

1. Smoking. Discontinuation of smoking is advised for at least 2 weeks prior to surgery.

2. Sputum. A smear and culture of the sputum are obtained. If the culture is positive and/or leukocytes are found on the smear, antibiotics, usually ampicillin or tetracycline, are started.[33]

3. Mucolytics. Hydration is necessary to eliminate retained thick, dry mucus. Inhalation of fine water particles with direct deposition on the retained mucus results in a thinning of the secretions. Although intravenous hydration is not effective for retained, dry secretions, it prevents the further deposition of dry mucus.[36]

Direct deposition of water to the retained secretions is achieved by aerosol therapy. An aerosol is a suspension of liquid particles in a gas. Aerosols are generated by atomizers (if the liquid particles are of different sizes) and nebulizers (if the liquid particles are of uniform size). Increased airway resistance is expected with aerosol therapy due to the swelling of the secretions and the aggregation of aerosol particles.[16] The optimal solution for aerosol therapy is 0.25% or 0.45% saline,[26] since these solutions have a lesser increase of airway resistance than water.[36] To deposit the solution in the most distal parts of the bronchial tree, the aerosol particles must be smaller than 3 microns in diameter since at this size gravity does not have a significant effect and transportation to distal bronchioles is feasible.[36] Aerosol therapy is administered orally by spontaneous breathing or by IPPB in patients who cannot deep breathe spontaneously (VC less than 15 mL/kg).

Among the significant risks of aerosol therapy are acute lower airway obstruction, bronchospasm, and pulmonary infections.[36] Partial occlusion of the distal airway by retained secretions may become complete by the swelling of the secretions secondary to hydration. Aerosol particles are foreign to the bronchial mucosa and can produce bronchospasm. Pulmonary infection can occur from the use of contaminated equipment. Nosocomial organisms such as *Serratia marcescens* usually are the offending agents.

4. Bronchodilators. Good distribution of aerosol particles and the effective elimination of retained secretions are aided by increased bronchial lumen. Bronchodilators can be administered orally as a nebulizer, with IPPB (Bronkosol), or intravenously (Aminophyllin).

5. Chest physical therapy. The loosening of adherent secretions is achieved by chest percussion or vibration. This is followed by the postural drainage of the different segments of the lung to facilitate elimination of the secretions by gravity.

6. Teaching of respiratory maneuvers. The preoperative teaching of breathing exercises, the use of breathing muscles, of cough techniques, of postoperative procedures and equipment are helpful to gaining the cooperation of the postoperative patient.

Intestinal Preparation for Surgery

Intestinal resection occasionally is necessary in gynecologic patients with benign or malignant disease. In most instances, intestinal resection can be anticipated because of the nature of the disease, symptomatology, and findings on pelvic examination or radiologic evaluation of the intestinal tract. The wound infection rate is increased in surgical patients who undergo an intestinal resection with an unprepared bowel. Studies have indicated that preparation of the intestinal tract prior to surgical resection is effective in reducing the wound infection rate postoperatively.[5,44]

Bacterial Physiology of the Intestinal Tract

A review of the bacterial flora of the intestinal tract in healthy patients is necessary to understand the role of preoperative bowel preparation.

In healthy persons the fasting small intestine contains minimal bacteria that rarely exceed 10^3 colony counting units/mL (ccu/mL).[14] The predominant potential pathogens are streptococci,[2] and there are no coliform organisms. The ratio of anaerobic to aerobic organisms is 1 : 1.[32] After meals the colony count temporarily increases by several logs, probably as a result of the ingestion of organisms not destroyed in the stomach. This number of bacteria is kept to a minimum, probably by the peristaltic action and chemical and immunologic factors of the small bowel. In the presence of stagnant contents, such as in small-bowel obstruction, blind loop syndrome, and slow intestinal transit, the number of bacteria is increased and coliform organisms are detected.[14] In the terminal ileum the concentration of organisms is normally increased to 10^5 to 10^6 ccu/mL.[15,32] In the colon the number of bacteria is markedly increased to 10^{11} to 10^{12} bacteria per gram of stool.[2,15] The predominant organisms are anaerobic bacteria, especially *Bacteroides* species and coliform organisms, for a ratio of 1,000 : 1, respectively.[2] It is believed that the bacteria in the small bowel are mainly in transit toward the colon, although it plays a role in the synthesis of vitamin K and some group B vitamins.[32] In the colon the high number of bacteria has a major antibacterial effect on other organisms, the anaerobic microflora being the most important.[32] In addition, colonic bacteria contribute to the fermentation of undigested food in the colon.[32]

Preoperative reduction of the number of intestinal organisms in bowel surgery has resulted in a decreased rate of postoperative wound infection,[5,15] as demonstrated in numerous studies. However, no studies on small intestine surgery are available, and whereas the healthy small bowel contains almost no organisms, the distal ileum[15] and obstructed bowel do. It seems bowel preparation also may be beneficial in selected patients having surgery on the small intestine, in addition to those undergoing colorectal surgery.

Intestinal Preparation

Intestinal preparation is designed to eliminate bowel contents and reduce the number of bacteria.

Cleansing of the Bowel Contents. The surgery is aided when the intestine is empty. Moreover, gross intraoperative spillage is prevented. The spillage of even small amounts of colon contents with high numbers of pathogenic organisms is a significant factor in postoperative infection. Preoperative laxative infection. Preoperative laxatives and cleansing enemas are used to empty the bowel (Table 5-1). Cleansing the bowel alone, however, does not appear to be effective in reducing the postoperative wound infection rate. Studies comparing mechanical cleansing alone with mechanical cleansing in conjunction with neomycin and erythromycin have shown reduced infection rates in the latter group.[5,28] In a large multicenter study the infection rate for the mechanical cleansing group was 35% compared with 9% for the mechanical cleansing plus antibiotics group.[5] Thus, both antibiotic and mechanical bowel preparation are necessary for best results.

Reduction of Bacterial Count. The reduction of bacterial counts is achieved by the administration of antibiotics. This can be carried out orally, parenterally, or in combination.

Oral Antibiotics. The administration of a regimen of antibiotics orally has been shown to effectively reduce the colonic bacterial counts by four or five logs.[43] Antibiotics with minimal or no intestinal absorption are preferable since maximal intraluminal effect is achieved. However, antibiotics with intestinal absorption provide tissue antibiotic concentrations, which also help to reduce postoperative infection. Numerous antibiotic regimens are effective in reducing the surgical infection associated with colorectal surgery. The combination of an aminoglycoside (neomycin or kanamycin sulfate) with an antibiotic effective against anaerobes (erythromycin, metronidazole, or tetracycline hydrochloride) has provided optimal results in the reduction of postoperative infections.[5,43,44] The antibiotic combination regimes have been far more effective than single-drug regimens with or without effectiveness against anaerobes.[5,15,43,44] In one study the combination of neomycin plus oxytetracycline (Terramycin) was shown to be more effective than neomycin alone in reducing the postoperative infection rate. Patients in the former group had a postoperative infection rate of 5%, compared with 43% for those receiving only neomycin.[44] The intestinal preparation regimen used in gynecologic patients at the University of Kansas Medical Center is shown in Table 5-8. The preoperative administration of combination oral antibiotics to colorectal surgery patients is simple, inexpensive, and has been proved effective in reducing postoperative infection.

Parenteral Antibiotics. The administration of parenteral antibiotics to patients without oral antibiotic preparation has been shown effective in reducing postoperative infections. The preoperative use of a combination of parenteral antibiotics has been more effective than a single-antibiotic regimen with or without anaerobic coverage.[9] The administration of an aminoglycoside (gentamicin) with an antibiotic effective against anaerobes (lincomycin, clindamycin, metronidazole) has provided better results than when either one is used alone.[9,22] The continuation of antibiotic administration for several days postoperatively does not result in an additional benefit[15] to the two preoperative dosages.

Oral Plus Parenteral Antibiotic Administration. The question of whether a combination of high-tissue antibiotic concentration and the reduction of intraluminal intestinal organisms is more effective than either regimen alone has not been answered conclusively.[15] Because a low infection rate (3% to 5%) occurs with either regimen, a large number of patients are necessary to demonstrate results that are statistically significant. Studies comparing neo-

TABLE 5-8. Neomycin-Oxytetracycline 48-Hour Bowel Preparation

Days Before Surgery	Laxatives	Enemas*	Antibiotics	Other
2	Phosphosoda 15 cc orally 6 AM, 4 PM	2 in PM	Neomycin 1 g Oxytetracycline (Terramycin) 250 mg orally at 1, 2, 3, 4 PM	Liquid diet; 10 glasses of water
1	Phosphosoda 15 cc orally 6 AM	2 in AM 2 in PM	Neomycin 1 g Oxytetracycline 250 mg orally at 9 AM and 1, 5, 9 PM	Liquid diet; 10 glasses of water; vitamin K 1 mg IM
0				NPO; aspirate rectum 6 AM q 2 h until surgery

* 1,000 cc tap water.
NPO, nothing by mouth.

mycin plus erythromycin and neomycin plus metronidazole with and without additional parenteral antibiotics have indicated low infection rates in both groups; however, the number of patients was too small for a statistically significant conclusion to be drawn.[1,15]

In summary, the preoperative administration of antibiotics in combination (aminoglycoside plus an antibiotic with anaerobic coverage), orally or parenterally, has resulted in significantly decreased postoperative infection rates in patients undergoing colorectal surgery. It seems that oral administration is simple, inexpensive, and equally effective. When feasible, oral administration should be therefore the method of choice. Parenteral antibiotics should be used when oral administration is not possible as in patients with a bowel obstruction or in an emergency. The addition of parenteral antibiotics to an effective oral regimen does not seem to be of additional benefit for bowel preparation in the majority of patients.

References

1. Barber MS, Hirschberg BC, Rice CL, et al: Parenteral antibiotics in elective colon surgery? A prospective, controlled clinical study. *Surgery* 1979; 86:23–29.
2. Bartlett JG: Choosing and using antibiotics, in Condon RE, DeCosse JJ (eds): *Surgical Care, A Physiological Approach to Clinical Management.* Philadelphia, Lea & Febiger, 1980, pp 273–301.
3. Basson MD: Preoperative Pulmonary Evaluation. *Res Staff Phys* 1982; 28:41–46.
4. Bunker JP, Forrest WH, Mosteller F, et al: The National Health and Studies, Study of the Possible Association Between Halothane and Postoperative Hepatic Necrosis. Bethesda, National Institutes of Health, National Institute of General Medical Sciences, 1969.
5. Clarke JS, Condon RE, Bartlett JG, et al: Preoperative oral antibiotics reduce septic complications of colon operations: Results of prospective, randomized, double-blind clinical study. *Ann Surg* 1977; 186:251–259.
6. Committee on Prevention of Rheumatic Fever and Bacterial Endocarditis of The American Heart Association: Prevention of Bacterial Endocarditis. *Circulation* 1977; 56:139A–143A.

7. Dripps RD, Lamont A, Eckenhoff JE: The role of anesthesia in surgical mortality. *JAMA* 1961; 178:261–266.
8. FDA Drug Bulletin, Vol. 13, No. 2:13–14, 1983.
9. Feathers RS, Lewis AAM, Sagor GR, et al: Prophylactic systemic antibiotics in colorectal surgery. Lancet 1977; 2:4–8.
10. Feigal DW, Blaisdell FW: The estimation of surgical risk. *Med Clin North Am* 1979; 63:1131–1143.
11. Gold MI, Helvich M: A study of the complications related to anesthesia in asthmatic patients. *Anesth Analg* 1963; 42:283–293.
12. Goldman L, Caldera DL, Nussbaum SR, et al: Multifactorial index of cardiac risk in noncardiac surgical procedures. *N Engl J Med* 1977; 297:845–850.
13. Goldman L, Caldera DL, Southwick FS, et al: Cardiac risk factors and complications in non-cardiac surgery. *Medicine* 1978; 57:357–370.
14. Goldstein F: Bacterial populations of the gut in health and disease: Clinical aspects, in Bockus HL (ed): *Gastroenterology,* vol 2, Philadelphia, WB Saunders Co, 1976, pp 152–169.
15. Guglielmo BJ, Hohn DC, Koo PJ, et al: Antibiotic prophylaxis in surgical procedures. *Arch Surg* 1983; 118:943–955.
16. Guidelines for Respiratory Therapy, Department of Anesthesiology, Section of Respiratory Therapy, University of Kansas Medical Center, 1979–1980.
17. Harman E, Lillington, G: Pulmonary risk factors in surgery. *Med Clin North Am* 1979; 63:1289–1298.
18. Hewlett AM, Branthwaite MA: Postoperative pulmonary function. *Br J Anaesthes* 1975; 47:102–107.
19. Iverson LIG, Ecker RR, Fox HE, et al: A comparative study of IPPB, the incentive spirometer and blow bottles: The prevention of atelectasis following cardiac surgery. *Ann Thorac Surg* 1978; 25:197–200.
20. Katholi RE, Nolan SP, McGuire LB: The management of anticoagulation during non-cardiac operations in patients with prosthetic heart valves. *Am Heart J* 1978; 96:163–165.
21. Katz RL, Bigger JT Jr: Cardiac arrhythmias during anesthesia and operation. *Anesthesiology* 1970; 33:193–213.
22. Keithley MRB, Crapp AR, Burdon DW, et al: Prophylaxis against anaerobic sepsis in bowel surgery. *Br J Surg* 1976; 63:538–541.
23. Knapp RB, Topkins MJ, Artusio JF: The cerebrovascular accident in coronary occlusion in anesthesia. *JAMA* 1962; 182:332–334.
24. Latimer RG, Dickman M, Day WC, et al: Ventilatory patterns and pulmonary complications after upper abdominal surgery determined by preoperative and postoperative computerized spirometry and blood gas analysis. *Am J Surg* 1971; 122:622–632.
25. Lewin I, Lerner AG, Green SH, et al: Physical class and physiologic status in prediction of operative mortality in the aged sick. *Ann Surg* 1971; 174:217–231.
26. Modell JH: Experimental studies in chronic exposure to ultrasonic nebulized aerosol. *J Asthma Res* 1968; 5:223–229.
27. Neely WA: Postoperative respiratory insufficiency: physiologic studies with therapeutic implications. *Ann Surg* 1970; 171:679–685.
28. Nichols RL, Broido P, Condon RE, et al: Effect of preoperative neomycin-erythromycin intestinal preparation on the incidence of infectious complications following colon surgery. *Ann Surg* 1973; 178:453–462.
29. Robbins JA, Mushlin AI: Preoperative evaluation of the healthy patient. *Med Clin North Am* 1979; 63:1145–1156.
30. Robbins J, Rose S: Partial thromboplastin time screening test. *Ann Intern Med* 1979; 90:796–797.
31. Rose S, Corman LC, Mason DT: Cardiac risk factors in patients undergoing noncardiac surgery. *Med Clin North Am* 1979; 63:1271–1288.
32. Schaedler RW, Goldstein F: Bacterial populations of the gut in health and disease: Basic microbiological aspects, in Bockus HL (ed): *Gastroenterology,* vol 2, Philadelphia, WB Saunders Co, 1976, pp 145–152.

33. Schlueter DP: Pulmonary complications, in Mattingly RF (ed): *TeLinde's Operative Gynecology.* Philadelphia, JB Lippincott Co, 1977, pp 57–63.
34. Shapiro B: Evaluation of respiratory function in the perioperative period. ASA Refresher Courses No 222: 1–8, 1979.
35. Shapiro BA: Acute respiratory failure in the surgical patient, in Beal JM (ed): *Critical Care of Surgical Patients.* New York, MacMillan, 1982, pp 3–14.
36. Shapiro BA, Harman PO: Bronchial hygiene therapy, in Beal JM (ed): *Critical Care of Surgical Patients.* New York, Macmillan, 1982, pp 55–69.
37. Stein M, Koota GM, Simon M, et al: Pulmonary evaluation of surgical patients. *JAMA* 1962; 181:765–770.
38. Stein MA: Preoperative pulmonary function evaluation and therapy for surgical patients. *JAMA* 1970; 211:787–790.
39. Tarhan S, Moffitt EA, Taylor WF, et al: Myocardial infarction after general anesthesia. *JAMA* 1972; 220:1451–1454.
40. Tinker JH, Noback CR, Vlietstra RE, et al: Management of patients with heart disease for noncardiac surgery. *JAMA* 1981; 246:1348–1350.
41. Topkins MJ, Artusio JF: Myocardial infarction and surgery: A five-year study. *Anesth Analges Curr Res* 1964; 43:716–720.
42. Vanik PE, Davis MS: Cardiac arrhythmias during halothane anesthesia. *Anesth Analges* 1968; 47:299–307.
43. Wapnick S, Guinto R, Reizis I, et al: Reduction of postoperative infection in elective colon surgery with preoperative administration of kanamycin and erythromycin. *Surgery* 1979; 85:317–321.
44. Washington JA II, Dearing WH, Judd ES, et al: Effect of preoperative antibiotic regimen on development of infection after intestinal surgery: prospective, randomized, double-blind study. *Ann Surg* 1974; 180:567–572.
45. Williams TJ, Pratt JH: Deaths in gynecologic surgery: Survey and evaluation. *Am J Obstet Gynecol* 1966; 95:185–191.

6 Cervical Conization

Conization of the uterine cervix was first described by Lisfranc in 1815 and the techniques, indications, and adjunctive procedures have been modified significantly since that time. In 1861 Simms sutured the cervix, and Sturmdorf, in 1916, described his inverting suture.[12] The use of the cryostat for rapid diagnosis in conization specimens was popularized by Rutledge and Ibanez.[10] Conization was most frequently used for diagnosing abnormal cervical cytologic specimens during the late 1960s. However, many of the previous indications for conization have been replaced by new procedures made available by technological advancement. Conization is rarely indicated for the repair of cervical lacerations, and cryosurgery has replaced it in the management of symptomatic chronic cervicitis. Likewise, colposcopy with directed biopsy has reduced the number of conizations performed in the investigation of abnormal cervical cytologies by 90% in most gynecology-oncology services today.

Preoperative Evaluation

Modern indications for conization are adjuncts to the more central diagnostic procedure of colposcopy. The author feels that no one should investigate an abnormal vaginal cytology without colposcopy available. If colposcopy is unavailable, the patient is referred, not operated upon. If a gross cervical lesion is present, biopsy, not conization, is indicated. There is no rationale for performing conization on a patient with a large cervical cancer when an office biopsy is quite sufficient. In addition to subjecting a patient to totally unnecessary surgery, appropriate therapy is delayed.

While morbidity secondary to recent conization is frequently discussed, Webb and Symmonds[14] and more recently Orr et al[5] reported that radical hysterectomy may be safely performed after conization regardless of the interval. The removal of the parametrium in radical surgery rather than cutting and clamping it in benign gynecologic surgery may explain this observation.

Modern indications for cervical conization include abnormal cytologic findings with normal colposcopic examination, a significant colposcopic lesion that extends into the endocervix in the absence of a gross cancer, suspicious histologic findings on endocervical curettage not diagnostic of cancer, and colposcopic biopsy of microinvasion where more extensive disease is suspected. Conization also may be primary therapy for a patient who does not wish a hysterectomy. Conization is rarely indicated in pregnancy, and colposcopy will prove to be quite accurate in most instances[6] due to physiologic eversion of the cervix.

Operative Technique

Place the patient in the lithotomy position and prepare and drape in the usual manner for vaginal surgery. The bladder is not emptied. Perform an examination under anesthesia. If colposcopic mapping of the known lesion is not available, the patient should have a colposcopic examination at the time of conization. Rubio and Thomassen evaluated Schiller's test in patients before conization and found false positive Schiller's test results in 32% of patients and false negative results in 60%.[8] Schiller's test is therefore unreliable in planning the surgical margin of conization specimens. The surgical technique is illustrated in Figs. 6-1 through 6-3.

If bleeding occurs in the conization margins, reinject the margins with vasoconstrictive solution and pack Avitene into the conization defect. An alternative method with excellent reported results has been described by VillaSanta.[13] With the No. 5 dilator in place, tie sutures over the cervix and remove the dilator; having the dilator in place prevents occlusion of the endocervix. In using this method, VillaSanta reduced postcone bleeding by 90% and reported no cervical stenosis in 500 patients.

Following the conization, no pack is placed in the vagina. Avoid Sturmdorf sutures as they produce necrosis and sloughing with intense reaction in the cervix, promoting delayed vaginal bleeding. Claman and Lee noted that any patient who bled in the hospital had a much greater likelihood of recurrent, more serious bleeding after discharge.[2] In their series of 1,008 cases, patients who were operated on by a less experienced surgeon, who were less than 30 years of age, and who had mass ligature or Sturmdorf and side stitches and vaginal packing had the highest incidence of complications, approaching 40%.[2]

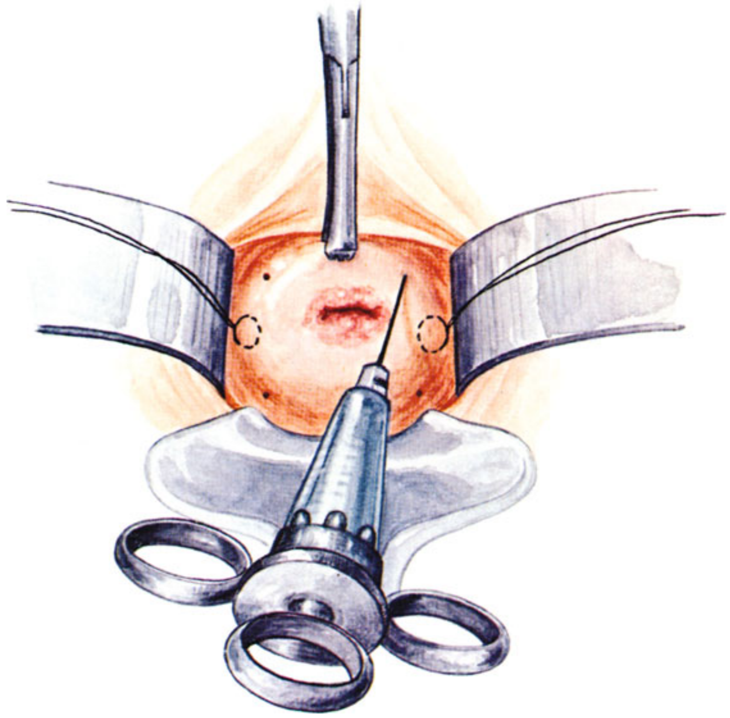


FIGURE 6-1. Bring the cervix down with a tenaculum and inject it with a solution of 1:100,000 epinephrine or 1:200,000 phenylephrine (Neo-Synephrine), 6 drops in 30 mL of saline. Place 2–0 absorbable sutures deep enough in the lateral margins of the cervix at 3 and 9 o'clock to surround the descending cervical branch of the uterine artery as it courses downward into the cervix. Tie these sutures with a square knot and leave the ends long.

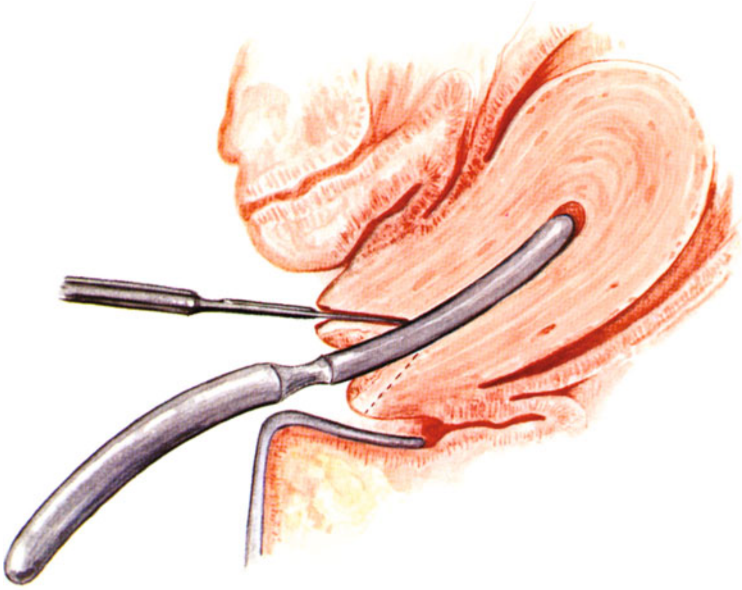


FIGURE 6-2. Insert a sound or No. 5 Hegar dilator into the cervix and with a No. 15 Bard-Parker blade sharply incise the specimen, using the dilator as a central focus for the end of the knife. It is important that a dilator or sound be used because many postconization bleeders have resulted from cutting across the central axis of the uterus with the tip of the blade and incising above the conization site deeply into the opposite uterine wall. Using an Allis clamp, grasp the cone as it is cut, pull it downward, and following excision place a suture at the 12 o'clock position in the conization specimen.

Furthermore, Claman and Lee documented an average complication rate of 25% and 10% postoperative bleeding, 3% morbidity, and 5% readmission rates.[2]

Rubio et al noted no relationship between postcone hemorrhage and the size of the conization.[9] The purposes of the cone should be foremost in the surgeon's mind when performing a cone. If the procedure is therapeutic, then the conization follows, if possible, the margins of the lesion to be excised. If the lesion extends high into the endocervical canal, then the cone must adequately excise tissues in this area.

Dorsey and Diggs reported excellent results with laser conization in an outpatient clinic.[3] Intra- and postoperative bleeding were minimal, patient

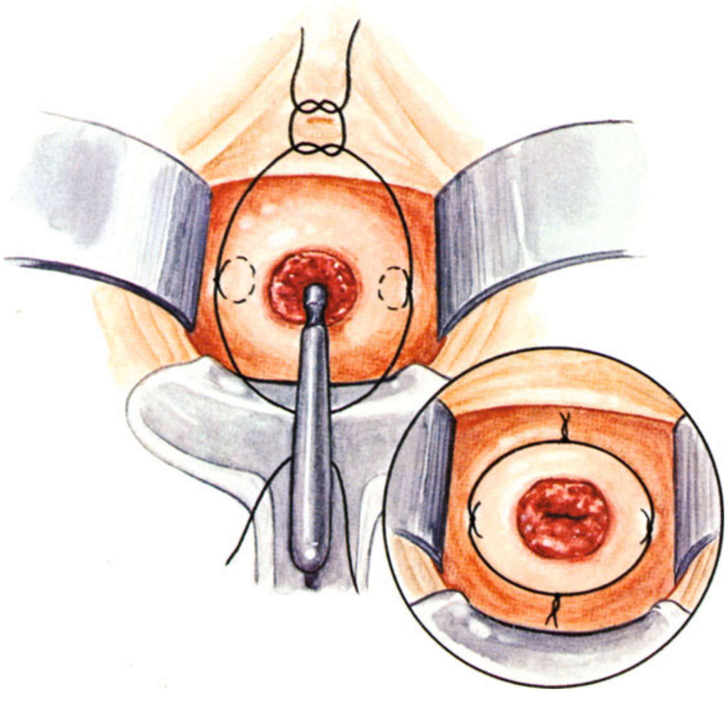


FIGURE 6-3. The endocervix and the endometrial cavity are curetted with a sharp curette as discussed in the section on Dilatation and Curettage in Chapter 1. The sound is replaced in the uterus and the ties are tied snugly over a No. 5 sound to avoid stenosis and stricture. The sound is removed. *Inset:* The sutures are tied and the ends of the absorbable suture are cut. Be certain not to tie the suture illustrated so tightly as to produce necrosis.

acceptance high, and the specimens obtained were quite adequate for microscopic studies. More recently Larsson reported similar experiences and concluded that laser conization may significantly reduce the frequency of early complications.[4] The laser conization technique is illustrated in Fig. 6-4.

Postoperative Management

The patient is dismissed 48 hours after conization. If a catheter was necessary postoperatively, remove the catheter prior to discharge and place the patient on a urinary antiseptic such as nitrofurantoin macrocrystals (Macrodantin), 50 mg qid for three days. Instruct the patient to abstain from intercourse for 2 weeks and prescribe a vaginal gel such as povidone-iodine (Betadine) or oxyquinoline sulfate (Triva), one-half an applicator every morning, for the first 10 days following conization.

The patient should return for a follow-up examination when the inflammatory changes have subsided approximately 6 weeks after conization. If the patient has any abnormal cytology after conization, reconization may be performed, although the author recommends simple hysterectomy after appropriate study to rule out invasive cancer. If the conization was performed in a young woman for treatment of cervical intraepithelial neoplasia, careful follow-

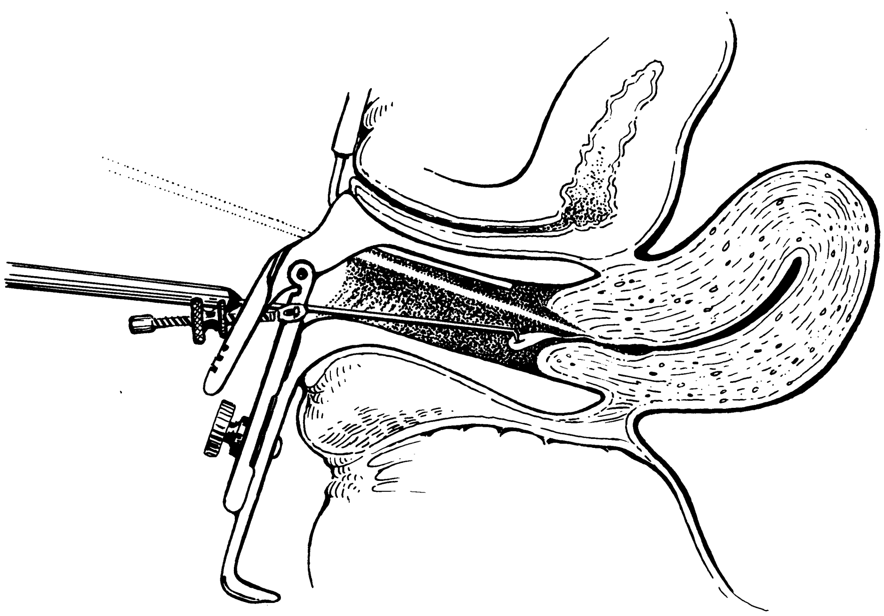


FIGURE 6-4. Place the patient in the lithotomy position. Observe laser safety precautions and place suction speculum in vagina. Attach smoke evacuator and bring laser to bear on the cervix. Use magnification in colposcope, which allows visualization of the entire cervix. Spray cervix with 3% acetic acid and allow epithelial changes to occur. Set laser at 20 W and using the beam director, outline the lesion to be excised. The operator should have clearly in mind the precise extent of the lesion. After outlining the cervical margins, direct the laser beginning inferiorly, in a cone-like fashion, vaporizing the margins as the cone is freed. Traction with a small skin hook aids in visualizing the apex of the cone. Excise the apex of the cone with a scissors or a knife as sharply as possible as the cervical tissue is thin in this area and the thermal damage from the laser may produce artifacts that will obscure histologic detail. Bleeding is usually minimal and may be controlled by directing the defocused laser beam at the bleeding vessels. Postoperative precautions and instructions are the same as cold knife conization.

up cytologic examinations are imperative. In the absence of abnormal cytology, routine follow-up and evaluation is in order, with a Papanicolaou smear every 3 months for the first year, at 6-month intervals in the second year, and yearly thereafter. If cytologic studies are negative for the first year, the chance of recurrence is 0.4%.[1]

Results

Conization is quite accurate when compared with colposcopic biopsy or random punch biopsy. Cervical conization approaches 99% diagnostic accuracy in patients having abnormal epithelial lesions of the cervix; the 1% failure group consists of patients with unsuspected invasive cancer. Punch biopsy is less accurate because of the smaller tissue sample and the possible coexistence of endocervical epithelial abnormalities. An atrophic cervix or a small vagina make the biopsy technically difficult. When punch biopsies are obtained in a ring fashion with six to eight biopsies and subsequent curettage, biopsy may approach 94% accuracy; however, this is a significant number of biopsies and careful histologic examination is better achieved with conization.[11]

The apparent increased incidence of Papillomavirus infections of the cervix with associated cytologic and microscopic abnormalities has complicated precise pathologic diagnosis of abnormal epithelial lesions of the cervix. The author is hopeful that such a clinical dilemma will be resolved shortly. Meanwhile, current clinical practice dictates that clinical management of Papillomavirus infections be based on and consistent with the severity of the epithelial abnormality microscopically identified.

Conization is successfully used for therapy. Bjerre et al performed cold-knife conization in 2,099 patients with abnormal Papanicolaou smears: 1,500 were found to have carcinoma in situ and conization alone was curative in 87% of these patients.[1] The cure rate did not depend on whether or not a resection margin was free of pathologic epithelium. Of the 1,500 patients, 156 had an additional cytologic abnormality; 8 of these patients were found to have invasive cancer. Others have followed conization with hysterectomy and found 22% to 27% of patients had residual cervical intraepithelial neoplasia in the hysterectomy specimen.

The author has long believed that there was no accurate predictability in his own material with regard to residual intraepithelial neoplasia in the uterine specimen. Ostergard showed that among patients with clear surgical margins of the cone, 16% will have residual disease within the uterus at hysterectomy.[7] Conversely, in patients with involved margins, 66% had no residual disease within the uterus. Ostergard notes that the routine comment by the pathologist on the status of conization clearance is still necessary for two reasons. First, a noncleared cone with cervical intraepithelial neoplasia (CIN) III at the margins may have more advanced disease remaining in the cervix. Second, the cleared cone offers reassurance that invasive cancer is not present. These conclusions were well documented in his review of 531 cervical cones and 268 hysterectomy specimens.

Although one might suspect that conization would greatly increase the risk of spontaneous abortion and premature delivery, Bjerre et al reported an abortion increase from 12% to only 17% after conization. There was no observed increase in the frequency of premature delivery due to conization.[1]

References

1. Bjerre B, Gosta E, Folke L, et al: Conization as only treatment of carcinoma in situ of the uterine cervix. *Am J Obstet Gynecol* 1976; 125:143–152.

2. Claman AD, Lee N: Factors that relate to complications of cone biopsy. *Am J Obstet Gynecol* 1974; 120:124–128.
3. Dorsey JH, Diggs ES: Microsurgical conization of the cervix by carbon dioxide laser. *Obstet Gynecol* 1979; 54:565–570.
4. Larsson G: Conization for preclinical carcinoma. *Acta Obstet Gynecol Scand Suppl* 1983; 114:7–40.
5. Orr JW, Shingleton HM, Hatch KD, et al: Correlation of perioperative morbidity and conization to radical hysterectomy interval. *Obstet Gynecol* 1982; 59:726–731.
6. Ortiz R, Newton M: Colposcopy in the management of abnormal cervical smears in pregnancy. *Am J Obstet Gynecol* 1971; 109:46–49.
7. Ostergard DR: Prediction of clearance of cervical intraepithelial neoplasia by conization. *Obstet Gynecol* 1980; 56:77–80.
8. Rubio CA, Thomassen P: A critical evaluation of the Schiller test in patients before conization. *Am J Obstet Gynecol* 1976; 125:96–99.
9. Rubio CA, Thomassen P, Kock Y: Influence of the size of cone specimens on postoperative hemorrhage. *Am J Obstet Gynecol* 1975; 122:939–944.
10. Rutledge F, Ibanez ML: Use of the cryostat in gynecologic surgery. *Am J Obstet Gynecol* 1962; 83:1208–1213.
11. Selim MA, So-Bosita JL, Blair OM, et al: Cervical biopsy versus conization. *Obstet Gynecol* 1973; 41:177–182.
12. van Nagell JR, Parker JC, Hicks LP, et al: Diagnostic and therapeutic efficacy of cervical conization. *Am J Obstet Gynecol* 1976; 124:134–139.
13. VillaSanta U: Hemostatic "Cerclage" after knife conization of the cervix. *Obstet Gynecol* 1973; 42:299–301.
14. Webb MJ, Symmonds RC: Radical hysterectomy: Influence of recent conization on morbidity and complications. *Obstet Gynecol* 1979; 53:290–292.

7 Vaginal Hysterectomy

Vaginal hysterectomy was a common procedure before the turn of the century, at which time abdominal surgery became safer owing to improved anesthetic techniques, blood transfusions, and antibiotics. Dr. N. Sproat Heaney of Chicago repopularized the use of vaginal hysterectomy as well as instruments for vaginal surgery.[21] The use of the vaginal hysterectomy procedure gradually increased, and it is a common gynecologic procedure today. The proportion of hysterectomies performed vaginally varies with the personal choice and training of the surgeon; however, in general, 48% to 70% of hysterectomies are performed vaginally.[5,24]

Preoperative Evaluation

The indications for vaginal hysterectomy are pelvic relaxation, metromenorrhagia, leiomyoma uteri, carcinoma in situ, sterilization, dysmenorrhea, and atypical adenomatous hyperplasia. Less common indications are adenomyosis, chronic cervicitis with discharge not responding to cryosurgery, and cervical stricture requiring repeated dilatation. Occasionally adenocarcinoma of the endometrium is given as an indication for vaginal hysterectomy; however, the author prefers to explore the patient and remove the ovaries, which may not always be done through the vaginal route. Peters et al noted cure rates comparable to that of abdominal hysterectomy where vaginal hysterectomy was used to treat adenocarcinoma of the endometrium in poor surgical-risk patients.[18] They reported one patient out of 56 who had a subsequent ovarian metastasis.

Indications

Pelvic Relaxation

Pelvic relaxation accounts for 40% of vaginal hysterectomies.[20] Vaginal hysterectomy combined with pelvic floor repair is the procedure of choice for uterine prolapse, enterocele, and cystocele. The surgeon must be aware that the addition of pelvic floor repair to vaginal hysterectomy in the young woman produces significant morbidity.

Metromenorrhagia

Metromenorrhagia accounts for 27% of vaginal hysterectomies.[20] Place these patients on oral iron therapy when seen preoperatively, as the patient often has diminished body iron stores as well as anemia, and transfusions may be avoided by increasing the patient's hemoglobin preoperatively. Examine the uterine cavity and cervix for malignant disease preoperatively in patients with abnormal uterine bleeding. A negative cytologic examination with a normal-appearing cervix and a sampling of the endometrial cavity by endometrial suction biopsy are adequate preoperative measures. If instruments cannot be passed into the uterine cavity preoperatively, curettage at the time of surgery is indicated, and any suspicious tissues are sent for frozen section. Any patient who has an abnormal-appearing cervix requires a cervical biopsy.

Leiomyoma Uteri

The use of vaginal hysterectomy in the treatment of uterine leiomyoma varies greatly in the literature, depending on the choice of the individual gynecologic surgeon. Pratt and Gunnlaugsson have shown that morcellation may be accomplished with essentially the same blood loss but with a 9% increase in morbidity and minor complications.[21] The author feels that it is unnecessary to extend indications for vaginal procedures to include the removal of large pelvic masses. The route and incision that provide the best exposure will ultimately provide the best result. An abdominal incision gives superior exposure for uteri larger than 10 weeks in size. Do not morcellate the uterus that has not been carefully sampled and intrauterine malignancy ruled out.

Carcinoma in Situ

Carcinoma in situ is treated by vaginal hysterectomy if the patient has completed her family. The lack of correlation of margins of in situ carcinoma and Schiller's test is discussed in Chapter 6. The inaccuracy of Schiller's test makes careful colposcopic mapping of the lesion and study of the upper vaginal mucosa essential prior to surgical removal. Any carcinoma in situ extending from the cervix onto the vagina is carefully marked with a marking pencil or outlined with a knife and excised at the time of vaginal hysterectomy by turning the cuff in. Fair-sized margins of carcinoma in situ extending off the cervix may be excised in this fashion, producing very little defect in the upper vagina. No special resection or radical procedure is necessary in the treatment of carcinoma in situ and simple vaginal hysterectomy will suffice. It may be simpler to remove the vaginal extension of the carcinoma in situ with a laser rather than produce a complicated surgical excision in association with a hysterectomy. The laser procedure should precede the hysterectomy and be allowed to heal prior to performing the vaginal hysterectomy.

Sterilization

Vaginal hysterectomy has been widely used as a means of sterilization in the woman who has completed her family. In the absence of any other indication, sterilization may be more safely and easily accomplished with an outpatient laparoscopic tubal ligation. The patient undergoing vaginal hysterectomy for sterilization may have an intrauterine device in place. Although Atkinson and Chappell observed no significant increase in morbidity in patients with an intrauterine device in place at the time of surgery,[2] the author recommends removal of the intrauterine device 2 weeks prior to surgery, as discussed below in Preoperative Preparation.

Dysmenorrhea

Dysmenorrhea without desired potential childbearing capacity is a justifiable indication for vaginal hysterectomy. The absence of uterine descensus sometimes seen in patients who have a long history of dysmenorrhea is not a contraindication. Careful preoperative psychologic evaluation is important. Patients with emotional problems and psychogenic dysmenorrhea do not benefit from surgery and will center their complaints in another gynecologic area or in a postoperative problem, with resultant unhappy patient and surgeon.

Atypical Adenomatous Hyperplasia

This condition is easily treated with vaginal hysterectomy. There should be no confusion as to the possibility of adenocarcinoma being present. If there is any doubt, abdominal hysterectomy is the procedure of choice to allow for abdominal exploration.

Obesity

Obesity as an indication for vaginal rather than abdominal removal of the uterus has been carefully studied by Pitkin.[19] He reported a series of obese patients who did not have any additional risks in vaginal hysterectomy as compared with an associated nonobese series. The limiting factor in vaginal hysterectomy is of course not the soft tissues but rather the bony structure. Patients who have a wide pubic arch will have excellent exposure in vaginal surgery; however, if the patient has a very narrow subpubic arch, exposure may be limited and often the abdominal route is a better choice in these patients.

Contraindications

Coulam and Pratt have studied the effect of previous pelvic surgery in 621 patients who underwent vaginal hysterectomy.[6] There was no significant difference in morbidity, complications, time of hospitalization, frequency of morcellation, transfusion rate, or postoperative hemoglobin drop in this group of patients when compared with a group of 942 patients who had no prior pelvic surgical procedures. They concluded that choice of vaginal route depends on the characteristics of the pelvis and not on the prior surgical procedure. They found that if the uterus was mobile and vaginal supporting structures relaxed, vaginal hysterectomy was quite satisfactory.

If the patient has had radiation therapy for some unrelated disease process, vaginal surgery and pelvic floor repair are approached with great caution and in general are not performed.

If there is any confusion as to uterine mobility then the abdominal route is preferred, allowing the surgeon careful direct visualization in uterine removal.

Preoperative Preparation

If the patient has an intrauterine device in place, the surgeon should remove it 2 weeks prior to surgery and place the patient on aerobic and anaerobic spectrum antibiotics. Recent studies indicate that intrauterine device users have a three- to fivefold increased risk of pelvic inflammatory disease over nonusers.[16] This evidence confirms the need for prophylactic treatment of the patient for pelvic inflammatory disease prior to vaginal hysterectomy.

Preparation of the vagina prior to vaginal hysterectomy has been shown to be quite effective in reducing bacterial flora in the vagina.[17] The essential factor in preoperative preparation appears to be in the mechanical dilution of bacteria present. While there is little difference between povidone-iodine and saline,[1] the author uses iodine preparation in painting the vagina after mechanical cleansing. The endocervix, however, frequently remains culture positive, and short-term prophylactic antibiotics such as the cephalosporins given prior to and at the time of surgery markedly decrease postoperative morbidity. There has been no increase in infections caused by resistant organisms nor does a prophylactic course of antibiotics predispose the patient to more severe or delayed infections.[15] Mayer and Gordon reported a decrease in febrile morbidity in vaginal hysterectomy patients from 43% to 8% with the prophylactic use of antibiotics.[14] Ledger et al have shown that there is little difference in short-term and long-term antibiotic therapy,[12] but an essential finding in all studies is that the maximum benefit is obtained if the patient has an adequate level of antibiotics in her bloodstream at the time the incision is made. There seem to be good results with almost any antibiotic. Cephalosporins in single dose appear quite satisfactory, and the different protein binding of the drugs appears to have little significance.[9]

Operative Technique

The position of the patient is critical for additional exposure. The patient must be well down on the operating table with the buttocks protruding from the edge of the table. The surgeon must personally assure himself of this position prior to preparation of the patient. The patient's legs must be well up from the field. There are numerous types of stirrups, both with the leg directly extended and with the leg in an obstetric-type stirrup or suspended with straps. Regardless of the stirrup used, it is essential to have adequate padding and no pressure points to avoid injury to the peroneal nerve and other neurologic injuries. Marked flexion of the thigh upon the abdomen also has been associated with femoral nerve palsies due to traction on the nerve by the rigid inguinal ligament.[25] Such extremes of posture should be avoided to minimize such injuries. A stirrup with a curved outer bar that does not come in contact with the leg, the Gyne-Loop,®* is a useful answer to this difficult operating room problem. In addition, surgical assistants should be cautioned against leaning against the inner aspect of the thigh, which can also contribute to the extreme posture.

Occasionally one will have a patient in whom vaginal exposure is difficult. Place the patient in a Trendelenburg position or lateral tilt position. A midline episiotomy may be used to increase exposure as well. Where additional manipulation is needed in the upper vagina, a large Schuchardt incision is performed in benign disease as well as for Schauta hysterectomy. Although significant exposure will be gained with this technique, the surgeon should be aware of the discomfort of a large Schuchardt incision and weigh this against the option of performing an abdominal hysterectomy and thus having the exposure needed.

The first assistant stands to the right of the surgeon if the surgeon is right-

* Gyne-Loop®, Gyneco, Inc, 51 Chubb Way, Branchburg, NJ 08876.

handed and the second assistant stands to the left. The scrub nurse will most conveniently pass instruments between the surgeon and the first assistant. Some surgeons prefer a small table affixed to the operating table for placement of instruments; the author finds this cumbersome. The second assistant can palm the suture scissors and the remainder of the instruments may be passed. The use of a large one-piece drape improves the draping and prevents large gaps. The author uses a half-sheet clipped to his lap and allows it to fall over his knees, as well as a skin towel clipped to his back.

The room is equipped with a dual light source with a switch for varying intensities, and a weighted speculum with suction and light source is useful.

Surgical instruments necessary for the vaginal hysterectomy include narrow Deaver retractors, the longer length being particularly useful when removing tubes and ovaries; Adson-Brown forceps in medium and long lengths; and fine, long Metzenbaum scissors. Sharp strong scissors may be available, but most of the lower ligamentous structures can be cut with a knife. The author uses vaginal hysterectomy clamps of his own design (Masterson clamp) to minimize the tissue trauma while maintaining traction on the vascular structures to tie ligatures.

Many techniques for vaginal hysterectomy have been described varying from using no clamp to a triple-clamp technique. It is emphasized that the surgeon should strive for minimal trauma, maximal exposure, and the least amount of devitalized tissue remaining with the smallest possible amount of suture material left in the wound.

The operation is illustrated in Figs. 7-1 through 7-11.

The use of T-tube drains and suction in vaginal hysterectomy has recently been proposed. Several authors have measured an average of 40 mL of fluid from such sites.[23] Careful attention to minimizing dead tissue and the use of fine suture material with a relatively dry pelvis at the time of closure is felt to be more satisfactory than the placement of a drain through a potentially infected wound, and its use is not recommended.

The use of dilute phenylephrine (Neo-Synephrine), as described in Fig. 7-1, improves hemostasis. Although some reports have been published to the contrary,[7] neither the author nor Laman Gray, in the more than 2,000 vaginal hysterectomies he personally performed, has experienced increased postoperative bleeding or infections.[8] In view of the difference between this experience and the literature, the reader should monitor future journal publications closely in this regard.

Postoperative Management and Complications

If vaginal hysterectomy without repair is performed, the patient is up the next day with regular diet as tolerated. Early ambulation is encouraged, as the patient has no abdominal wound. The patient is instructed to abstain from intercourse for 6 weeks and returns to the clinic at 2 and 6 weeks.

Byrd et al have studied the use of long-term estrogen support after hysterectomy and oophorectomy in 1,016 cases with 100% follow-up.[3] They noted that the general impact of long-term estrogen therapy following hysterectomy is favorable. Although there is much controversy about estrogen usage, the absence of the uterus obviates its greatest single complication. Where the ovaries remain and are functioning, estrogen therapy obviously need not be begun until menopausal symptoms occur. The author urges all patients who undergo a hysterectomy with oophorectomy or with nonfunctioning ovaries to accept estrogen supplementation. The gynecologic surgeon must never forget that more patients die of complications of osteoporosis than of uterine cancer.

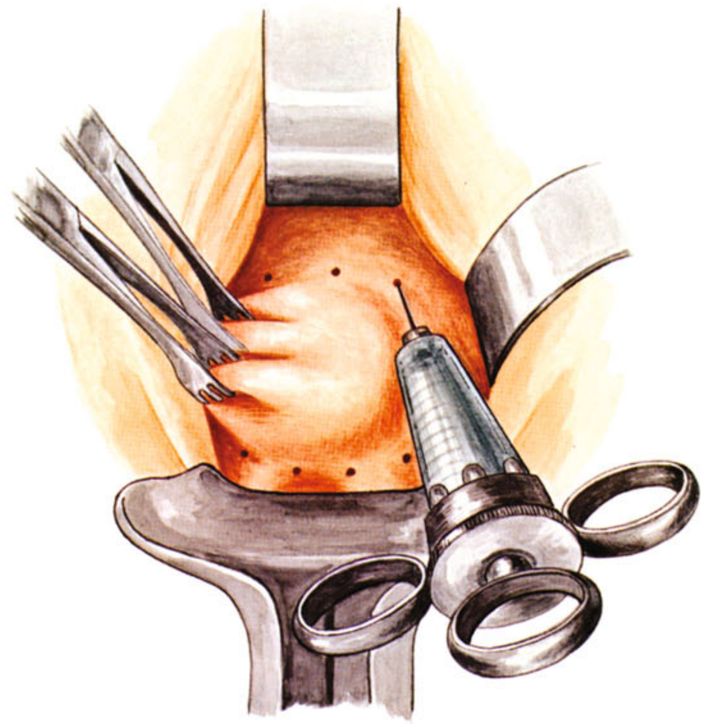


FIGURE 7-1. Empty the patient's bladder with a catheter. Insert a weighted speculum into the vagina with as long a blade as will stay fully in the vault. Place two Deaver retractors laterally in the vagina and two thyroid clamps well into the anterior and posterior lips of the cervix. The surgeon holds both of these in his left hand and injects a dilute solution of phenylephrine (Neo-Synephrine) in the approximate line of incision about the cervix. Liberally infiltrate the vaginal epithelium posteriorly to minimize vaginal bleeding.

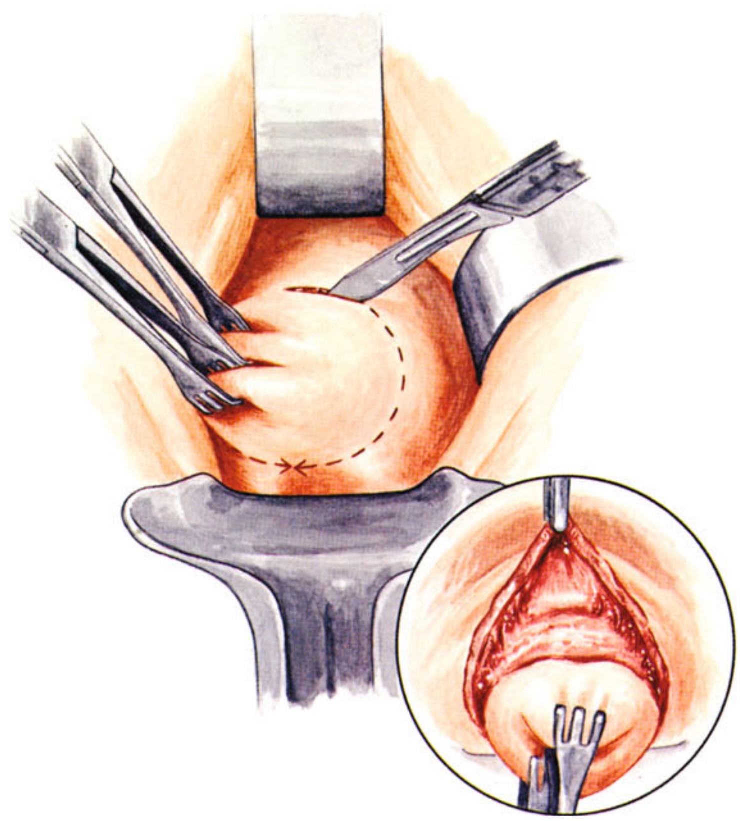


FIGURE 7-2. Using lateral traction, make a circumferential incision in the vaginal epithelium about the cervix. This incision is the crux of vaginal hysterectomy. It is made just as the vaginal epithelium sweeps upward from the cervix and deeply into the tissues beneath the vaginal epithelium but does not include the uterine muscle. A slight increase in resistance is felt as the knife blade enters the muscle. To determine the lower limits of the bladder, pass a malleable sound, palpating it through the bladder wall. Mobilizing the uterus upward will indicate the posterior cul-de-sac margins and lateral traction will often show a bulge in the vagina where the cardinal ligaments sweep downward. Place strong upward traction on the bladder with Adson-Brown thumb forceps either singly or in tandem to allow introduction into the plane between the bladder and uterus. If the vaginal incision is too deep, one will dissect into myometrium with significant bleeding. If the incision is too shallow, one can dissect into the bladder muscle. The space is marked with some strands of connective and areolar tissue as one approaches the most inferior portion of the anterior cul-de-sac.

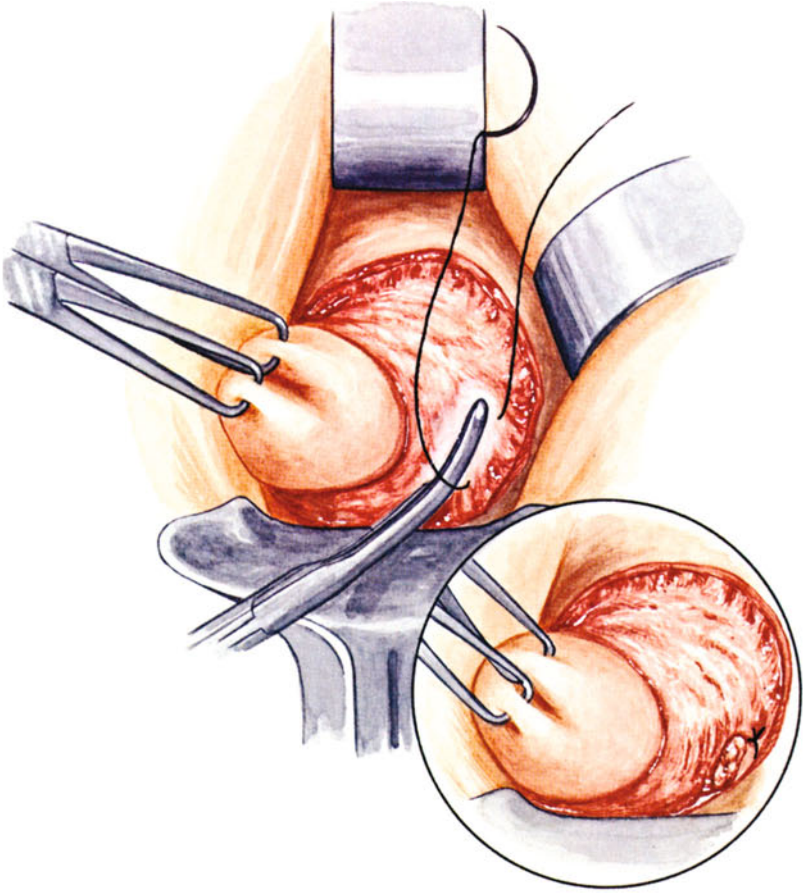


FIGURE 7-3. Strong traction is applied on the uterus and a Masterson clamp is placed on the lowermost portions of the supports of the uterus, namely the uterosacral ligaments. The clamp is cut free with a knife and an absorbable 2–0 suture is placed. *Inset:* Place a simple tie with three knots and cut the stitch near the knot. There is no reason to leave the ends of these sutures long, as each bit of suture left promotes infection in this area. The uterosacral ligament on the other side is handled in a similar fashion.

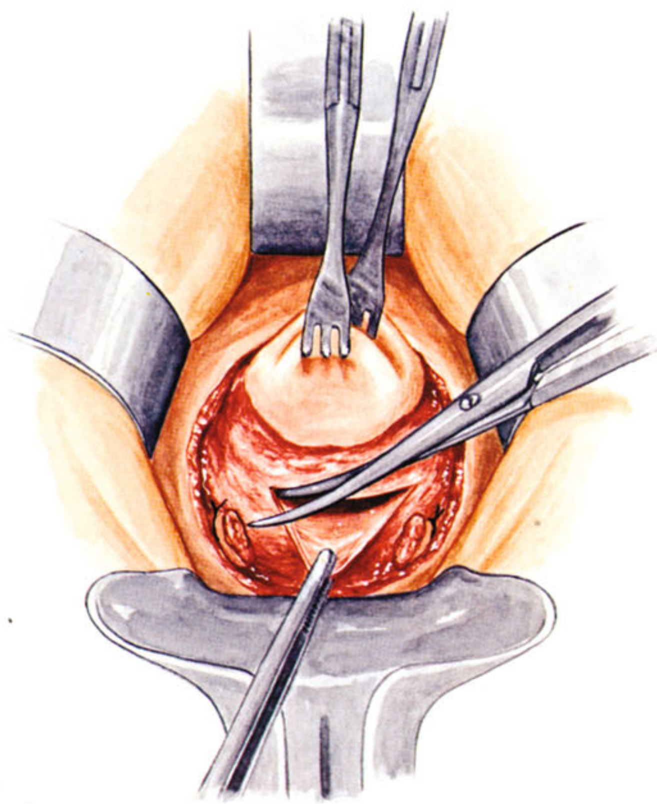


FIGURE 7-4. Although the cul-de-sac may be entered in some patients before any ligamentous structures are ligated, frequently it is more easily visualized after the uterosacral ligaments are tied. The uterus is pulled upward and the posterior cul-de-sac is visualized and entered. If there is any question as to whether or not this is truely the cul-de-sac, palpation will confirm that it is peritoneum. It is entered more safely in the midline and is cut to either margin to increase exposure. Although it is possible to extend the blade of the weighted speculum into the posterior cul-de-sac, this frequently puts lateral tension on the margins of the cul-de-sac and decreases exposure.

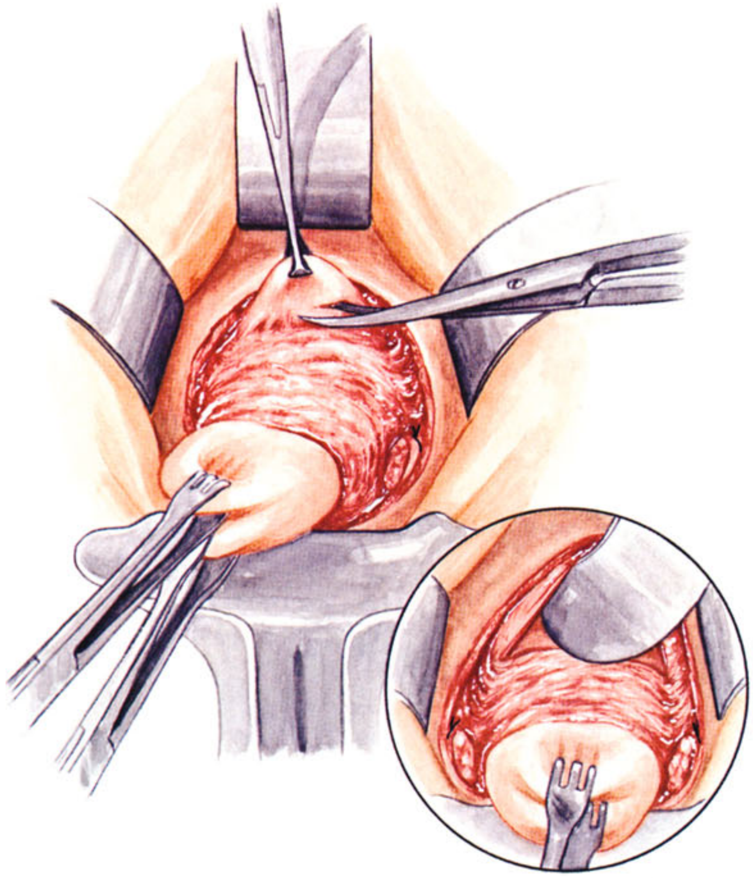


FIGURE 7-5. If difficulty is encountered in isolating the anterior cul-de-sac, place a finger anterior to the uterus. Using the finger as a guide, dissect the bladder upward to avoid entering the bladder, which may be adherent from prior cesarean section or other surgery. The anterior cul-de-sac is best visualized by pulling up with Adson-Brown thumb forceps and entering in the midline. *Inset:* Insert a Deaver retractor between the bladder and uterus.

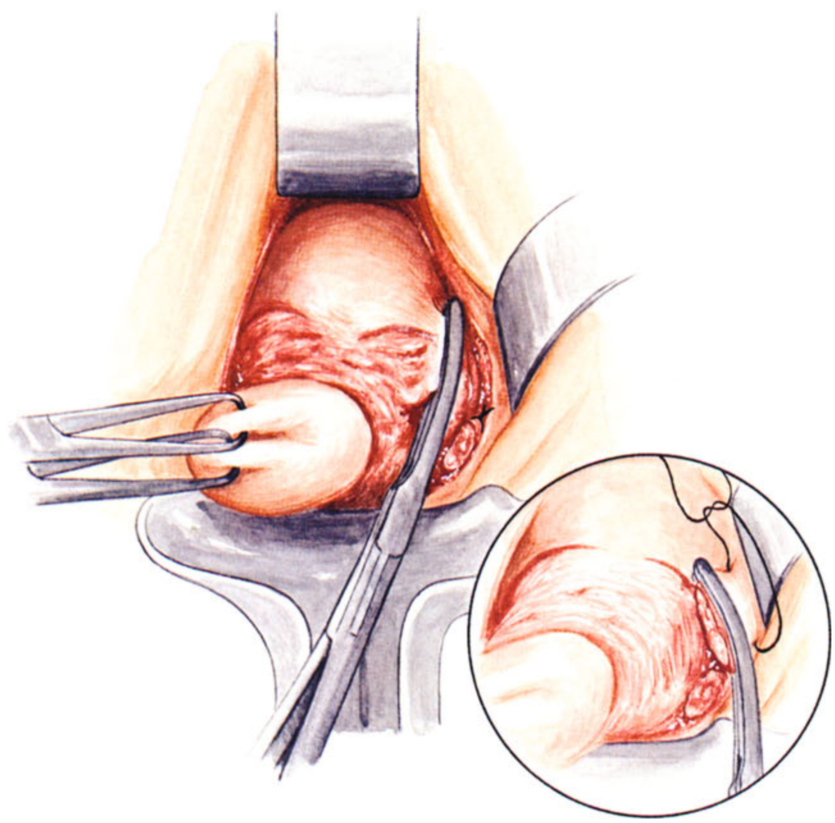


FIGURE 7-6. Strong downward traction is applied on the uterus, and the remaining part of the cardinal ligaments are singly clamped and cut with a knife. *Inset:* Tie the ligaments with 2–0 absorbable. Occasionally a difficult tie may require a large suture, in which case use 0 gauge absorbable. Single ties are adequate for these pedicles. Ties are carefully placed with the fingers in direct line, with tension being placed on the knot between the pads of the two index fingers. No sutures are tagged and the uterine arteries are also singly ligated.

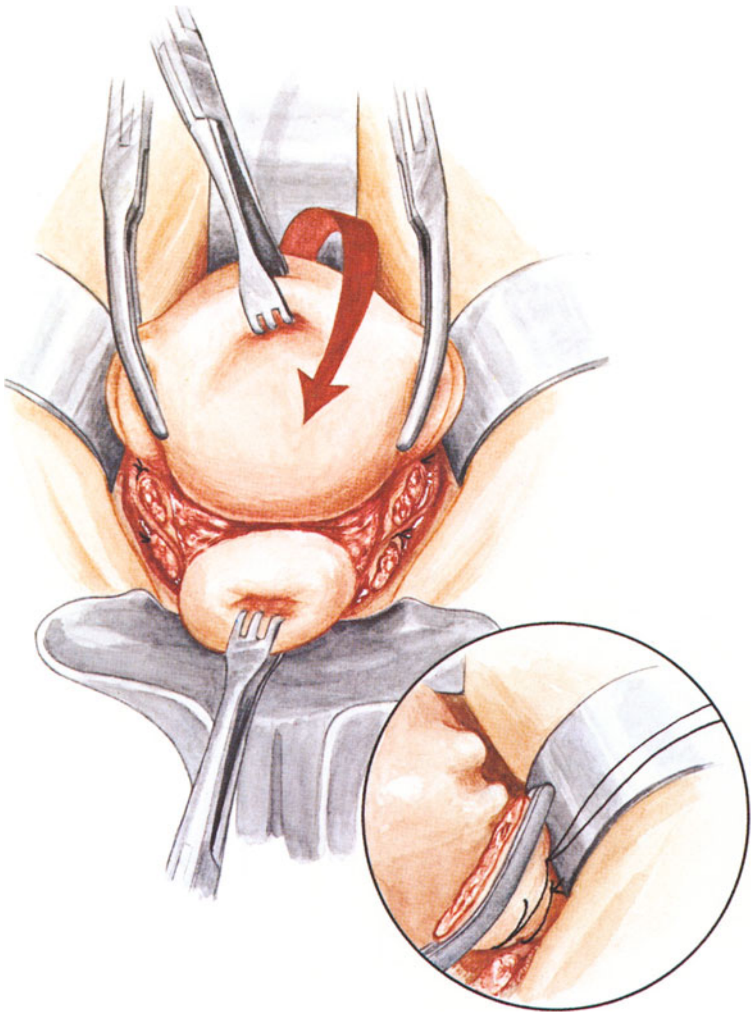


FIGURE 7-7. After ligating the uterosacrals, cardinal, and uterine arteries, place a thyroid clamp in the midline and pull the uterus downward. *Inset:* Place Masterson clamps laterally on the ovarian vessels and cut and doubly ligate them. The ovarian artery, which lies in the substance of the ovarian venous plexus, tends to retract and produce hematomas and thus must be securely tied. The initial ligature is a single tie around the pedicle. Next a transfixation suture going through the middle of the pedicle is singly tied and then passed around the entire pedicle. The distal tie is held while the other is cut short.

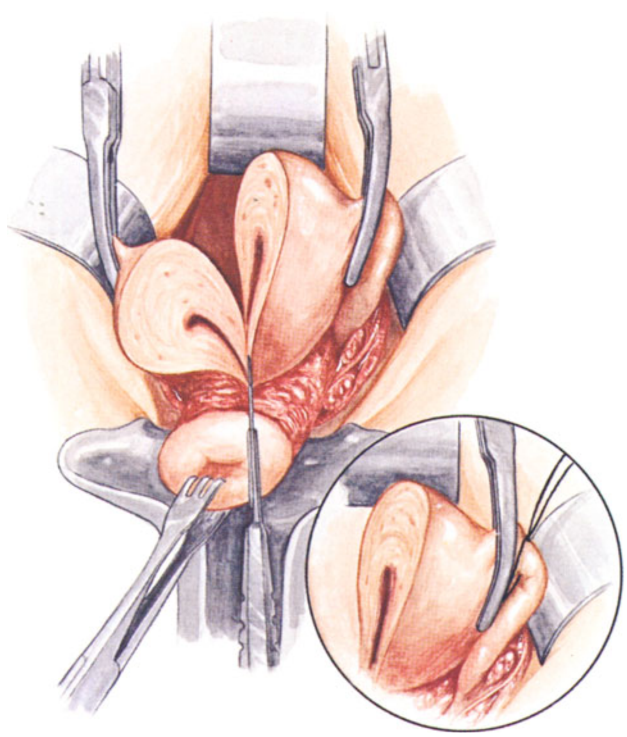


FIGURE 7-8. If visualization is difficult owing to uterine size or a narrow arch, additional exposure can be obtained by dividing the uterus in the midline. No morcellation or division of the uterus is permissible unless the uterine malignancy has been ruled out by uterine sampling. Place the index and middle fingers behind the uterus, incise in the groove between the fingers, and divide the uterus in the midline, placing a thyroid clamp on each side of the cervix. *Inset:* By pulling one-half of the uterus into the operative site, good exposure is obtained for lateral placement of Masterson clamps on the tubo-ovarian junctions. Each half of the uterus is then removed in this way with a significant increase in exposure.

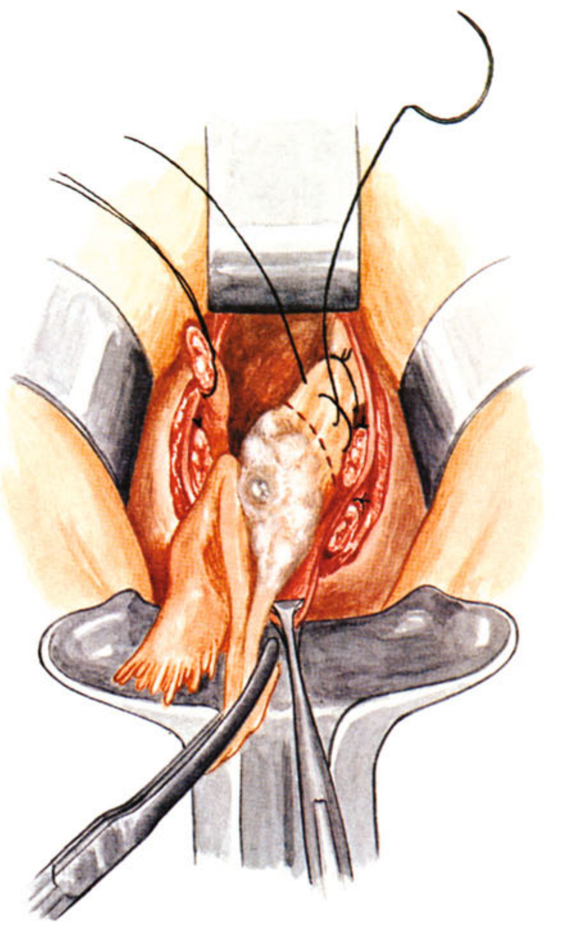


FIGURE 7-9. If the ovaries are to be removed, this is best performed following uterine removal. Pull the utero-ovarian pedicle down, freeing up any adhesions with scissors. With good visualization, a free tie is placed about the ovarian vessels, followed by a transfixation suture. The ovaries are then cut while the transfixation suture is held. The same procedure is performed on the other side, completing ovarian removal. If good exposure is not obtained and ovarian removal is mandatory, then an abdominal incision is made. In this, as in other procedures, one does not compromise exposure. Smale et al noted no serious complications other than one episode of bleeding in 355 cases of vaginal hysterectomy associated with bilateral or unilateral salpingo-oophorectomy.[22]

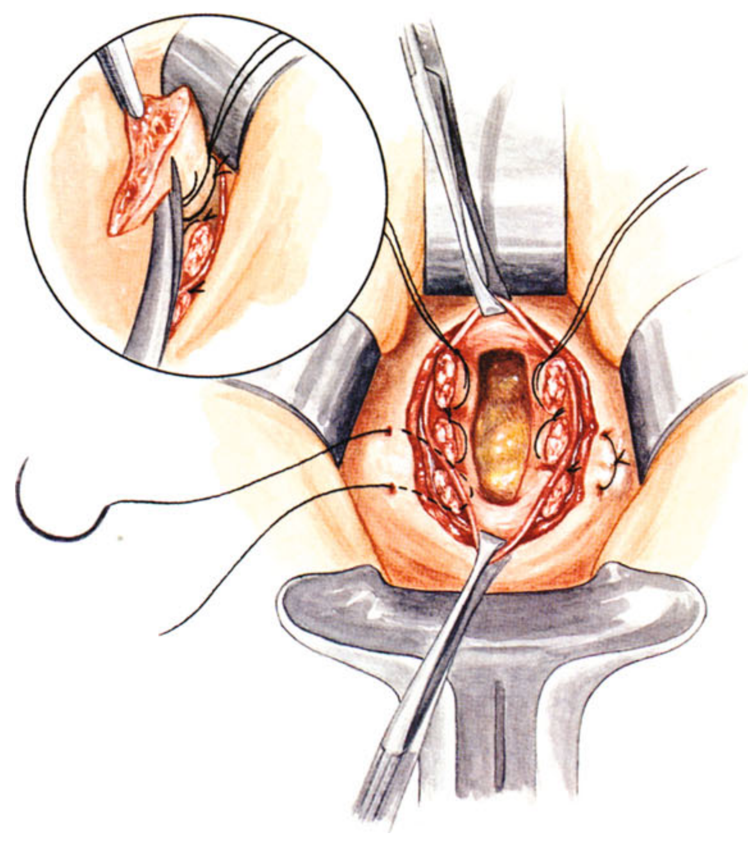


FIGURE 7-10. After any devitalized tissue is cut from the pedicles (*inset*), the uterine supports are sutured into the angles of the vagina with a simple stitch that encompasses all layers of the vaginal epithelium: It takes a full bite through the cardinal ligaments, comes back through the uterosacral ligament, and goes out again through the full thickness of the vagina. This will attach these structures firmly to the vaginal wall and produce good support. Vaginal vault prolapse is rare after the vault has been suspended in this fashion. It is important that these tissues be approximated and not strangulated so that they will heal, not necrose. The same procedure is performed on the opposite side.

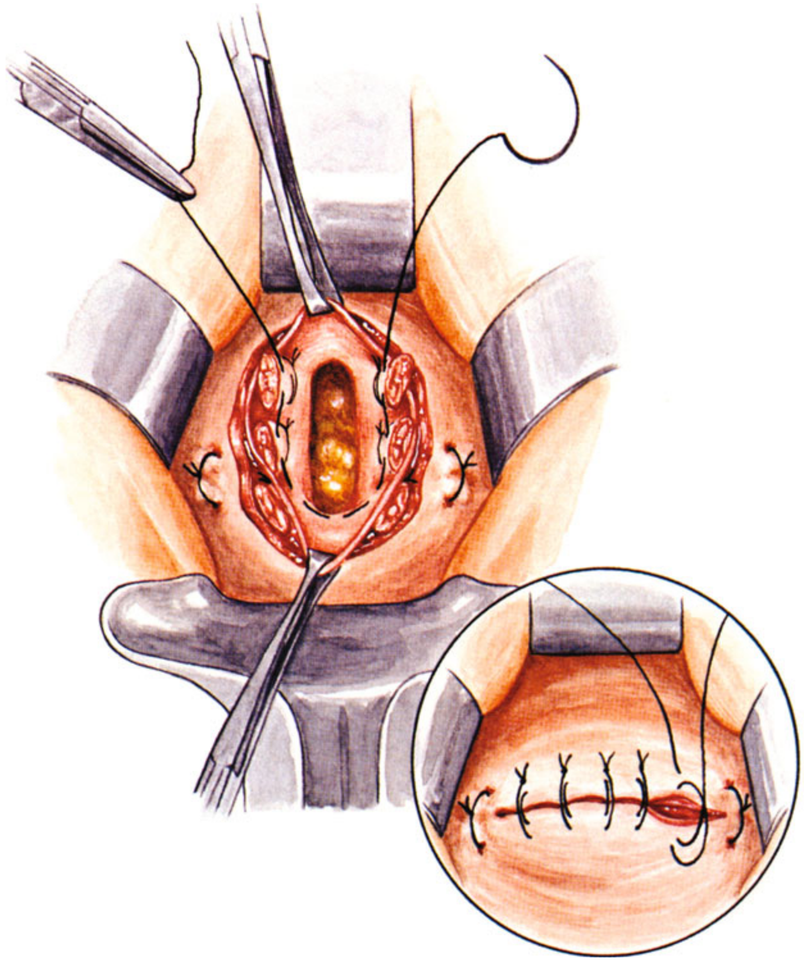


FIGURE 7-11. To close the peritoneal cavity, place a suture through the peritoneum from above and attach a small hemostat. Bring the suture down distal to the vascular ties and through the cardinal ligaments. If there is any excess peritoneum posteriorly, bring the suture well up on the peritoneum and excise the excess to prevent any tendency toward enterocele. Any additional reefing that is necessary may be done at this time by means of simple stitches imbricating the posterior cul-de-sac. Bring the suture up the opposite side and through the peritoneum again. Tying this down will produce an approximation of the peritoneum closing the peritoneal cavity. *Inset:* Close the vaginal vault with 3–0 absorbable suture using a large round needle. Place the stitch deeply through all layers, taking care not to enter the bladder anteriorly. Bring the stitch back and direct it through the margins of the vaginal epithelium and then approximate it. This stitch will both obliterate the underlying dead space and produce an anatomic approximation of the vaginal epithelium, greatly decreasing the instance of postoperative granulations. It is important not to include the ovaries in the vaginal closure, and no attempt is made to pull the tubes in the closure; this would increase the incidence of tubal epithelial prolapse, which would require treatment in the postoperative period. The closure of the vagina is an anatomic closure. Drains are not necessary. The wound is usually dry prior to closure and no pack is required. In the absence of any associated repair, a catheter is not used.

Estrogen supplementation is generally contraindicated, of course, in patients with endometrial or breast cancer.

Although ward service series are often reported with the comment that if the procedures were performed by more experienced surgeons the complications would be quite low, that is not necessarily the case. Harris reported

491 vaginal hysterectomies performed on private cases by board-certified gynecologists.[10] The incidence of febrile morbidity was 37.8%; 75 patients received prophylactic antibiotics and of these patients, 21.4% had febrile morbidity. The average length of hospital stay was 11 days.

Copenhaver, in his excellent study of vaginal hysterectomy, reported febrile morbidity in 39% of patients, cystitis in 29%, excessive vaginal bleeding in 3%, and severe urinary retention and pelvic cellulitis in 2%; severe pyelonephritis, pelvic hematomas, thrombophlebitis, and pelvic abscess occurred in a smaller number.[4] The reader is referred to the detailed table of complications resulting from both abdominal and vaginal hysterectomies in Chapter 15.

Bleeding

The principal complication of vaginal hysterectomy is bleeding. The average blood loss from vaginal hysterectomy with infiltration of a pressor agent is 305 mL with a range of 25 to 1,181 mL. When no pressor agents are used, the average operative blood loss is 755 mL. Operative transfusion is required in 35% of patients with infiltration and 80% of patients without infiltration. When pelvic repair is added to vaginal hysterectomy, 189 mL of additional blood loss is noted. When infiltrates are not used, an average of 305 mL is lost with associated repair.[11] Blood loss of this magnitude must be carefully monitored as it may approach 30% of the total blood volume of a small woman. Harris reports a 10.8% rate of hypovolemic shock in patients undergoing vaginal hysterectomy, with its attendant problems of increased infection rates and poor wound healing.[10]

To help reduce the blood loss, the author recommends the use of pressor agents such as a dilute solution of phenylephrine 1:200,000 not exceeding 30 mL or 1:400,000 if 60 mL of solution is used.

The sobering statistics of blood loss associated with vaginal hysterectomy make meticulous attention to technique essential, which includes precise identification of vessels with careful isolation and ligature, careful closure of the vaginal cuff, and precise placement of closure sutures so they do not enter behind a hemostatic stitch, producing hematoma proximal to the tie.

A patient who has had a vaginal hysterectomy and has unusual postoperative pain should be suspected of having concealed bleeding even though her initial hemoglobin level, blood pressure, and pulse may not indicate this. Any fall in blood pressure in association with severe abdominal pain is an indication that the patient should be re-explored. Prompt laparotomy is far preferable to the patient developing a large pelvic hematoma, sepsis, and multiple pelvic and abdominal abscesses with a prolonged postoperative recovery phase. There is approximately one laparotomy performed for postoperative bleeding for every 400 vaginal hysterectomies. The patient should be well aware that laparotomy is a realistic risk when vaginal hysterectomy is performed.[20]

Bladder Injuries

In Copenhaver's study, 1% of patients had bladder injuries from anterior colpotomy.[4] This injury is avoided through careful dissection with strong downward traction and the lifting upward of the bladder with thumb forceps. Often fluid may be present in the anterior cul-de-sac, producing some concern in the surgeon. If there is any confusion, a sound is placed in the bladder and the floor of the bladder is checked. If the bladder has been entered, close as described in Chapter 26.

Confining dissection upward to the midportion of the bladder obviates injury in an area where the ureter would be present, and ureteral injury is not of concern. If the surgeon feels there is any question of injury he should perform a cystoscopic examination of the patient at the end of the operation following injection of intravenous indigo carmine and observe the dye from both ureters. The repair may also be checked at that time. Detection of the bladder injury and its repair will almost always result in satisfactory healing.

If the bladder is entered, place a Foley catheter in the patient for seven days. Among 5,078 cases of vaginal hysterectomy at the Presbyterian Hospital in Chicago, only seven vesicovaginal fistulas were recorded.[4]

Ureteral Injuries

Ureteral injuries are rare. In a review of 11,279 vaginal hysterectomies, only four ureteral injuries were noted by Copenhaver.[4] If one remains close to the body of the uterus and uses strong downward traction and lateral tension with well-placed narrowed Deaver retractors, ureteral injury is rare indeed. Should the uterine artery or vein bleed lateral to the uterus, the use of fine Adson artery forceps to isolate this bleeder and tying with a fine 2–0 absorbable ligature will minimize ureteral injury. The lateral placement of a large clamp with suture ligature of large pedicles of tissue is hazardous.

Rectal Injury

Rectal injuries are usually associated with pelvic inflammatory disease or endometriosis and some pelvic fixation. Such uteri are removed abdominally, where better exposure can be obtained. If one is unable to clearly enter the posterior cul-de-sac, then the vaginal route is abandoned. Early entrance into both the anterior and posterior cul-de-sac with well-placed retractors produces a smooth, safe, and relatively bloodless vaginal hysterectomy. The use of excessive traction in a fixed uterus and the inability to enter these two areas make vaginal hysterectomy unsafe, and the procedure should be promptly abandoned.

Adnexal Abscess

Adnexal abscess may be seen after a vaginal hysterectomy. Such abscesses usually occur with a long latency period. The patient may frequently be premenopausal, have no prior history of pelvic inflammatory disease, have an uncomplicated surgical procedure and postoperative course, and have a normal pelvic exam at 6 weeks.[13] Patients have abdominal pain, nausea, and general findings of pelvic abscess. Usual treatment should include a combination of intensive antibiotic therapy and bilateral salpingo-oophorectomy.

Mortality

In a review of 13,441 vaginal hysterectomies by various authors, the incidence of death was 0.13%.[4] Most series of vaginal hysterectomies contained at least one death, often from embolic phenomena or associated vascular abnormalities. Although there may have been no error in surgical technique, the patient did die during the postoperative course of her vaginal hysterectomy. Even though the procedure may be accomplished with technical ease, associated death in the postoperative period makes the procedure, even in the most skilled hands, one that must be undertaken with the full realization that the patient may die as a result of operation.

References

1. Amstey MS, Jones AP: Preparation of the vagina for surgery: A comparison of povidine-iodine and saline solution. *JAMA* 1981; 245:839–841.
2. Atkinson SM, Chappell SM: Sterilization by vaginal hysterectomy. *Obstet Gynecol* 1972; 39:759–766.
3. Byrd BF, Burch JC, Vaughn WK: The impact of long term estrogen support after hysterectomy: A report of 1016 cases. *Ann Surg* 1977; 185:574–580.
4. Copenhaver EH: Vaginal hysterectomy: An analysis of indications and complications among 1000 operations. *Am J Obstet Gynecol* 1962; 84:123–128.
5. Copenhaver EH: Hysterectomy: Vaginal versus abdominal. *Surg Clin North Am* 1965; 45:751–763.
6. Coulam CB, Pratt JH: Vaginal hysterectomy: Is previous pelvic operation a contraindication? *Am J Obstet Gynecol* 1973; 116:252–260.
7. England GT, Randall HW, Graves WL: Impairment of tissue defenses by vasoconstrictors in vaginal hysterectomies. *Obstet Gynecol* 1983; 61:271–274.
8. Gray LA: Personal communication. 1984.
9. Hamod KA, Spence MR, King TM: Prophylactic antibiotics in vaginal hysterectomy: A review. *Obstet Gynecol Surv* 1982; 37:207–216.
10. Harris BA: Vaginal hysterectomy in a community hospital. *NY State J Med* 1976; 76:1304–1307.
11. Lazar MR: Blood loss prevention in vaginal surgery. *Surg Clin North Am* 1959; 39:1671–1677.
12. Ledger WJ, Gee C, Lewis WP: Guidelines for antibiotic prophylaxis in gynecology. *Am J Obstet Gynecol* 1975; 121:1038–1045.
13. Livengood CH III, Addison WA: Adnexal abscess as a delayed complication of vaginal hysterectomy. *Am J Obstet Gynecol* 1982; 143:596–597.
14. Mayer W, Gordon M: Prophylactic antibiotics: Use in hysterectomy. *NY State J Med* 1976; 76:2144–2147.
15. Ohm MJ, Galask RP: The effect of antibiotic prophylaxis on patients undergoing vaginal operations: The effect on morbidity. *Am J Obstet Gynecol* 1975; 123:590–596.
16. Ory HW: A review of the association between intrauterine devices and acute pelvic inflammatory disease. *J Reprod Med* 1978; 20:200–204.
17. Osborne NG, Wright RC: Effect of preoperative scrub on the bacterial flora of the endocervix and vagina. *Obstet Gynecol* 1977; 50:148–150.
18. Peters WA III, Andersen WA, Thornton WN Jr, et al: The selective use of vaginal hysterectomy in the management of adenocarcinoma of the endometrium. *Am J Obstet Gynecol* 1983; 146:285–291.
19. Pitkin RM: Vaginal hysterectomy in obese women. *Obstet Gynecol* 1977; 49:567–569.
20. Pratt JH: Common complications of vaginal hysterectomy: Thoughts regarding their prevention and management. *Clin Obstet Gynecol* 1976; 19:645–659.
21. Pratt JH, Gunnlaugsson GH: Vaginal hysterectomy by morcellation. *Mayo Clin Proc* 1976; 45:374–387.
22. Smale LE, Smale ML, Wilkening RL, et al: Salpingo-oophorectomy at the time of vaginal hysterectomy. *Am J Obstet Gynecol* 1978; 131:122–128.
23. Swartz WH, Tanaree P: T-tube suction drainage and/or prophylactic antibiotics: A randomized study of 451 hysterectomies. *Obstet Gynecol* 1976; 47:665–670.
24. Tasche LW: 1700 vaginal hysterectomies. *Minn Med* 1968; 51:1705–1711.
25. Tondare AS, Nadkarni AV, Sathe CH, et al: Femoral neuropathy: A complication of lithotomy position under spinal anaesthesia. *Can Anaesth Soc J* 1983; 30:84–86.

Bibliography

Gray LA: *Vaginal Hysterectomy: Indications, technique,* and *complications.* 3rd ed. Springfield, Ill, Charles C Thomas, 1983.

8 Pelvic Relaxation and Associated Conditions: Enterocele Repair

Historically, treatment of pelvic relaxation has varied from astringents, silver nitrate, tampons of okum and wool, pelvic massage, pessaries, red hot iron bars, sulfuric acid, hanging by the heels to cervical amputation. Surgical attempts in the late 19th and early 20th century included hysterectomy, round ligament uterine suspension, and Manchester and Watkins interposition operations. The LaForte operation is included in this group, although it too has generally been discarded.[11]

Enterocele, rectocele, cystocele, vaginal vault prolapse, and uterine prolapse are presented as separate entities. In practice, one rarely sees these conditions as isolated occurrences, but rather in varying degrees or in combination with one another (Figs. 8-1 through 8-3).

Pelvic relaxation has been associated with numerous etiologic factors. Holland reviewed the etiologic factors in genital prolapse and determined that the effect of childbirth was the most significant independent factor.[3] Frequency of genital prolapse increases only slightly with rising parity, being most common in the para 2 to 3. Age is an additional factor. Folsome et al studied 680 females, 611 of whom were over 60 years of age.[1] They found rectoceles in 45%, cystoceles in 25%, uterine prolapse in 11%, and enterocele in one patient. Only 10% of the patients had symptoms referable to these findings.

Kuhn studied the anatomy of the rectovaginal pouch and septum in 44 women in order to establish the normal range of the dimensions of this anatomic area.[5] He noted no relationship between the depth of the rectovaginal pouch and the presence of enterocele in this laparoscopic study.

Almost any condition associated with increasing intra-abdominal pressure will increase the incidence of genital prolapse. This includes chronic obstructive pulmonary disease with cough, chronic constipation requiring repeated Valsalva maneuver, obesity, visceroptosis, and large abdominal or pelvic tumors. Poor nutritional status has also been observed in this group of patients.

Preoperative Evaluation

The diagnosis of enterocele is considered when the patient presents with a bulge in the posterior wall and complains of a feeling of pelvic heaviness, which is often accentuated by straining. Other symptoms include low back pain and, occasionally, with a large enterocele, some nausea with straining, protrusion, and constipation.

FIGURE 8-1. An enterocele, which may or may not contain small bowel, may coexist with rectocele or exist independently. To identify an enterocele, place the third finger in the rectum and the index finger in the vagina and feel the enterocele between the two fingers.

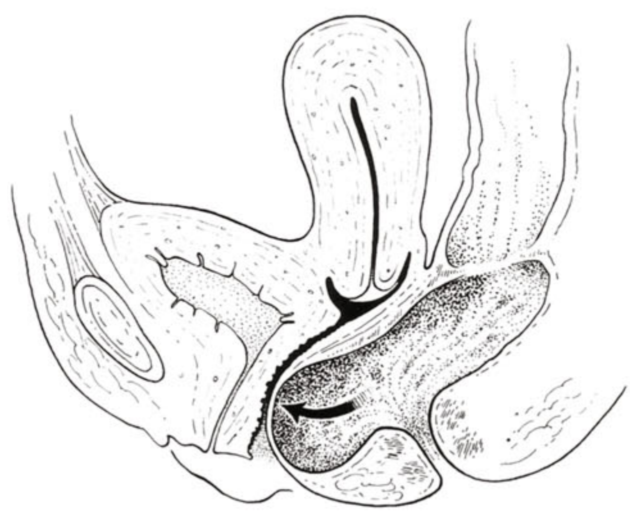


FIGURE 8-2. With the patient straining downward, the rectocele is observed as a bulging from the posterior aspect into the vagina. The central portion of the rectocele may be quite thin and difficult to outline.

FIGURE 8-3. The presence of a cystocele may initially be noted only when the patient is straining. As the supports of the bladder weaken, the downward bulge will increase. As the bladder moves downward, the urethrovesicovaginal angle increases, maintaining continence; stress incontinence is therefore unusual with large cystoceles. Suburethral cysts and urethral diverticula, if large, may occasionally be confused with cystoceles, but their diagnosis becomes apparent on closer inspection.

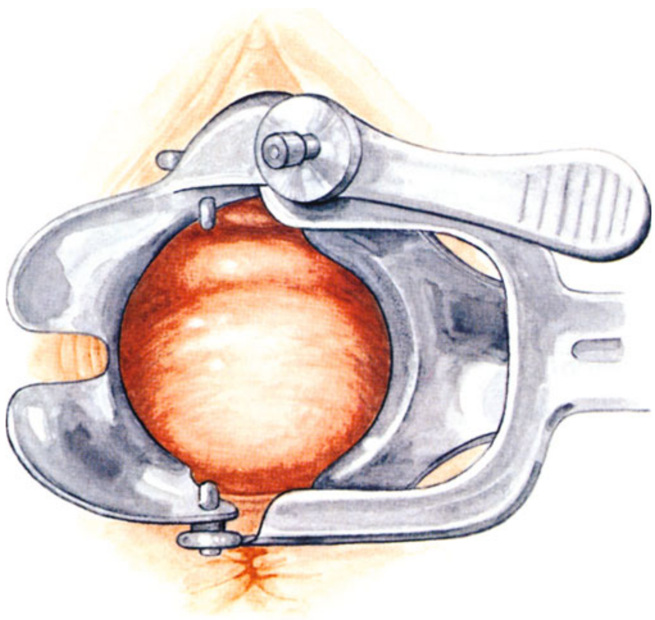


FIGURE 8-4. To differentiate enterocele and rectocele, place a vaginal speculum transversely in the introitus. When opened, a secondary bulge will be seen below the cervix and between any rectocele present. Place the index finger in the introitus and identify the rectum; then, on removing the speculum, palpate the sac between the index and middle fingers. A small bowel series obtained with lateral films will show the bowel descending into the enterocele sac when a diagnostic problem arises.

Retcovaginal examination may reveal a thickening of the rectovaginal septum that varies with straining; the bowel may sometimes be palpated between the two fingers (Fig. 8-4).

Although there are numerous classifications of enteroceles, the classification used here is based on their relationship to other pelvic structures at the time the procedure is performed.

Operative Technique

Congenital Enterocele Repair

This particular type of enterocele may occur in the nulliparous patient, as did the first case reported by Marion in 1909.[12] The etiology of this interesting defect, which may occur without other observed abnormalities, is explained by the anatomic studies of Milley and Nichols.[7] These authors studied 143 anatomic specimens in their investigation of the existence of rectovaginal septum in the human female. They demonstrated that a definite rectovaginal septum exists in the human female and is well formed by the 14th fetal week. It consists of a vertical sheet of dense connective tissue that is translucent in the fresh state and parallels the sacral curvature. It also fuses posterolaterally with the parietal endopelvic fascia and extends inferiorly from the rectouterine peritoneal pouch to the perineal body. This structure is usually adherent to the posterior aspect of the vaginal connective tissue capsule. A bluish character to this septum was noted. Failure of fusion of this structure and its persistent connection to the rectal uterine pouch allows descent of small bowel into this cavity. Repair of this defect follows the basic principles of hernia repair: careful isolation of the sac, excision of the sac with high ligation of the neck of the defect, and its fixation to stronger surrounding tissues with obliteration of the prior space occupied by the hernia. Good results should be expected in this isolated defect where the remainder of the pelvic supporting structures have normal strength (Figs. 8-5 through 8-7).

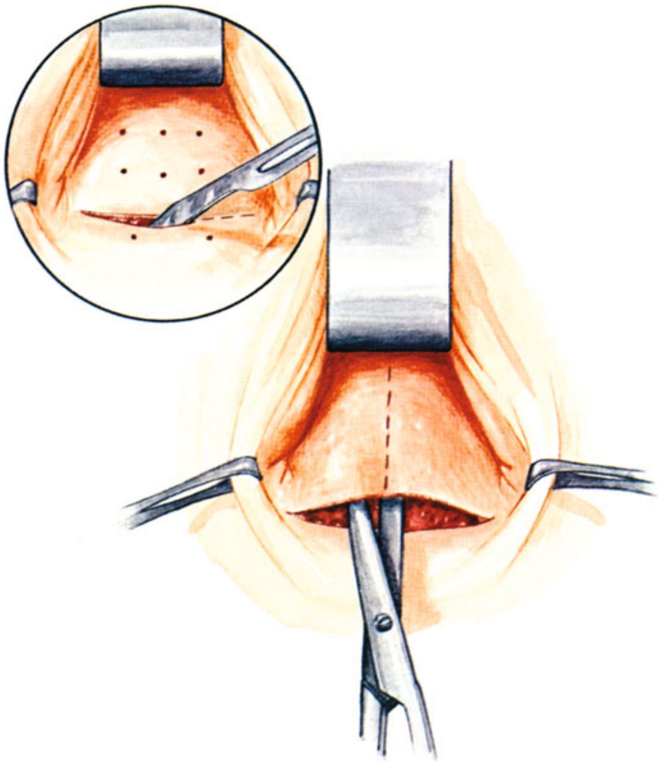


FIGURE 8-5. Congenital enterocele repair. Infiltrate the vaginal epithelium with a dilute solution of phenylephrine (Neo-Synephrine) and make a transverse incision; traction is applied laying the field out as flat as possible (*inset*). Place the Deaver retractor upward and pull the vaginal epithelium anteriorly. Use sharp dissection and incise the vagina in the midline to establish the plane and carry the incision upward.

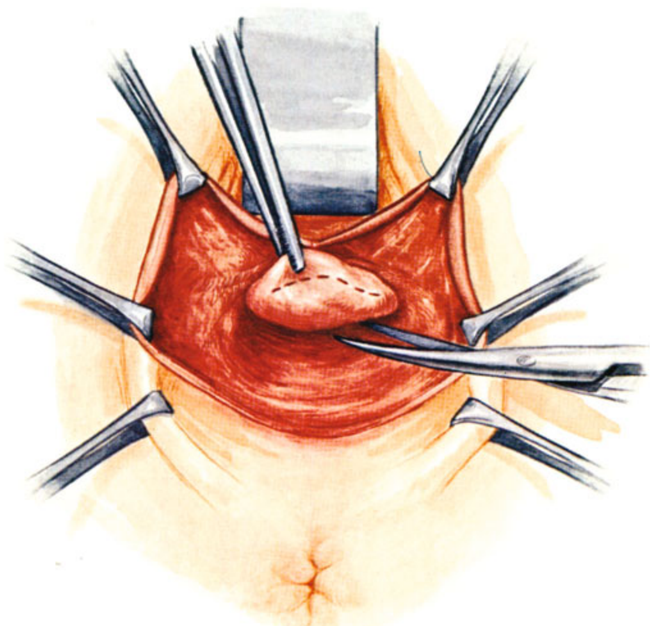


FIGURE 8-6. The enterocele sac will be seen bulging downward between the rectovaginal septum and the posterior surface of the cervix. If the enterocele alone is to be repaired, dissect it from the surrounding tissues. The sac will contain small bowel or omentum, which may slide out of the sac when the patient is placed in the lithotomy position. Pulling upward with Adson-Brown thumb forceps, enter the sac in the midline and define the extent of the defect.

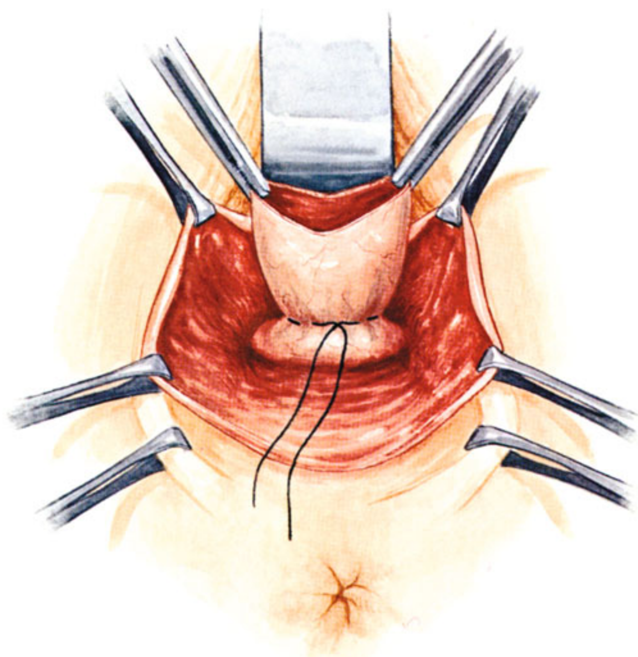


FIGURE 8-7. Ligate the upper margin of the sac with 2–0 absorbable suture and place an additional stitch below it, transfixing the margins, and excise the sac. Place sufficient traction on the sac when it is ligated so that the sac will move slightly upward when released.

Prophylactic Repair for Enterocele

This is the most common enterocele repair performed and is associated with other vaginal and abdominal procedures such as vaginal hysterectomy for prolapse or abdominal hysterectomy when a very deep cul-de-sac is noted. With the vaginal approach the McCall uterosacral plication[6] (Figs. 8-8 through 8-10) or Waters culdoplasty[12] is performed; abdominal repair is performed

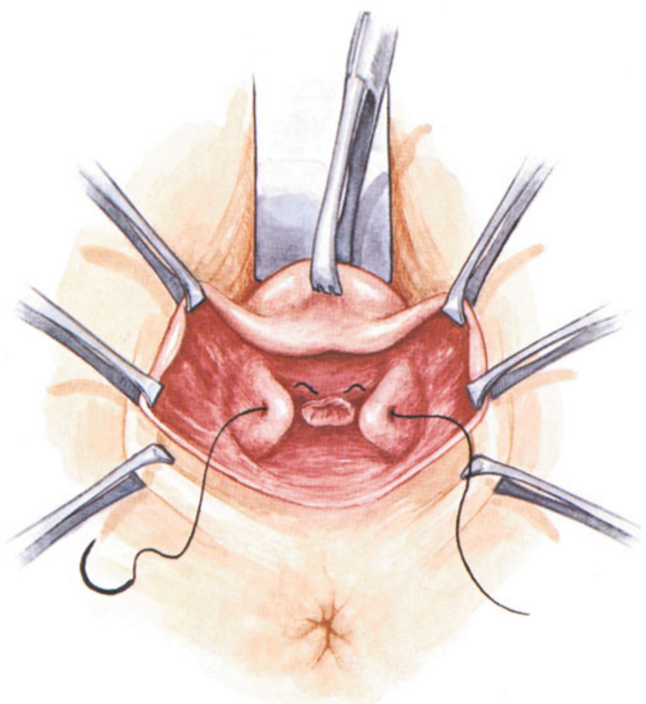


FIGURE 8-8. McCall uterosacral plication for prophylactic repair of enterocele. Identify the uterosacral ligaments by pulling the cervix upward with a tenaculum. Place a 2–0 absorbable suture through the uterosacral ligament taking a lateral bite of peritoneum high in the cul-de-sac and continuing through to the opposite ligament.

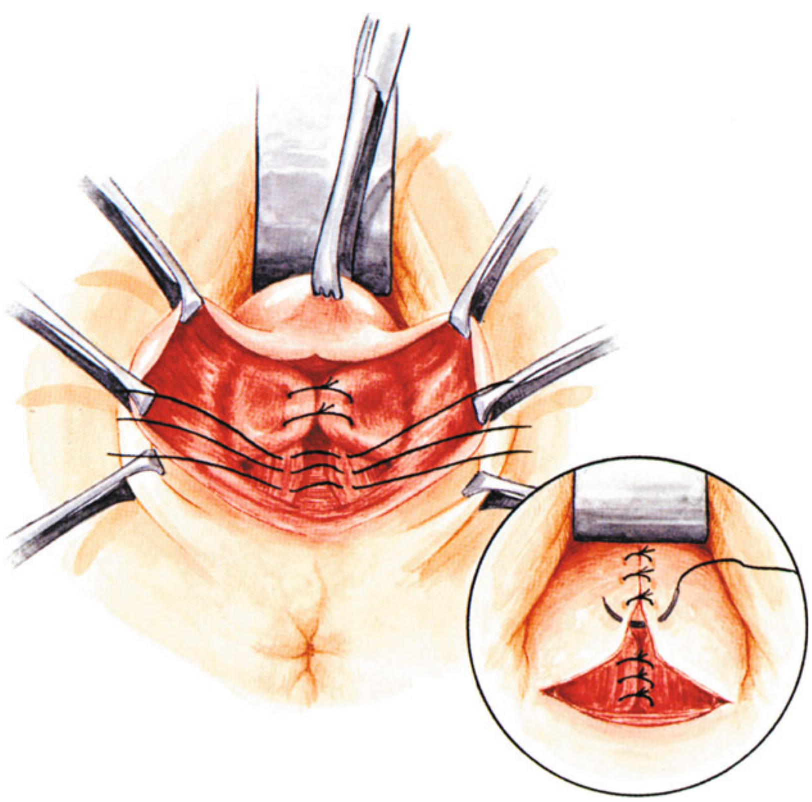


FIGURE 8-9. Imbricate the area below the uterosacral ligaments with interrupted sutures of 2–0 absorbable. *Inset:* Close the vagina with interrupted absorbable sutures.

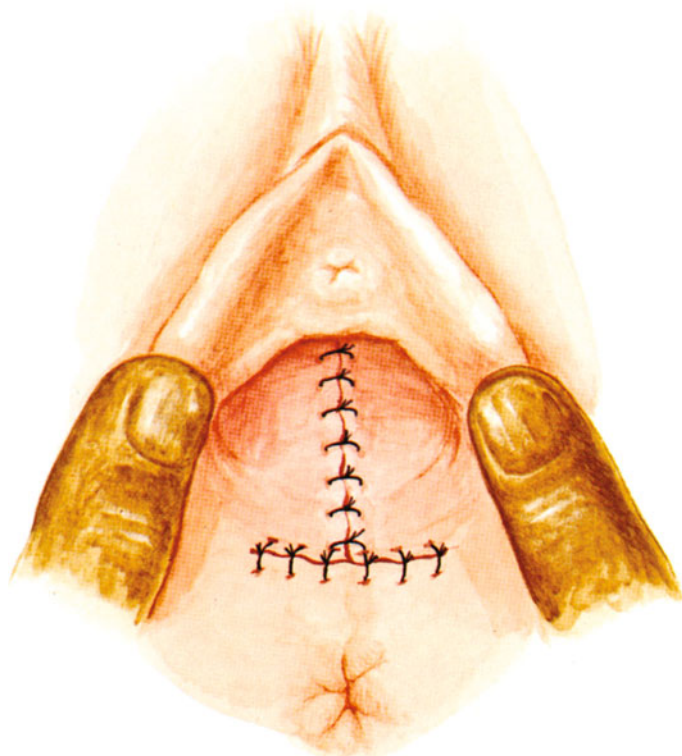


FIGURE 8-10. Continue closure of the skin incision by approximating the vaginal epithlium. Be careful to avoid introital stricture. Close the skin with interrupted 3–0 nylon sutures or a subcuticular 3–0 absorbable suture.

as in the Moschcowitz procedure[8] (Fig. 8-11). All these procedures consist of reducing the area available for a bowel prolapse and strengthening the defect with available endopelvic fascia. Pratt[10] noted that 3% of patients develope enteroceles after vaginal hysterectomy and Hunter et al,[4] in a review of the literature, found 15 cases of ruptured enterocele following a vaginal operation. In a review of 38 cases of vaginal evisceration, there were three deaths,[2] emphasizing the need for prophylactic repair to avoid this serious complication. The author advises including it whenever the anatomy of the cul-de-sac indicates it is worthwhile.

Combined Groups of Procedures

Enterocele exists in association with vaginal wall prolapse, uterine prolapse, and rectocele. The basic principles in this type of procedure, which must be modified when enterocele is associated with the other defects, consist of the excision of the enterocele sac, high ligation of its neck—minimizing the defect for subsequent herniation—and closure of the central defects. It is important to remember that chromic gut, Vicryl, and Dexon lose almost all tissue strength by 21 days.[9] Silk likewise deteriorates, and the suture used for permanent repair of these defects should be polypropylene, Dacron, or nylon, which maintain their strength for some time and are not associated with fistula formation. Prolene has the disagreeable tendency to require a large number of knots, whose presence may be palpated in the vagina.

An important technical point in the surgery of any of these defects in which peritoneum alone is sutured is that good exposure is mandatory. To avoid bowel obstruction or fistula formation, be careful not to include small bowel in the peritoneal closure as small bowel and peritoneum resemble each other high in the vaginal repair.

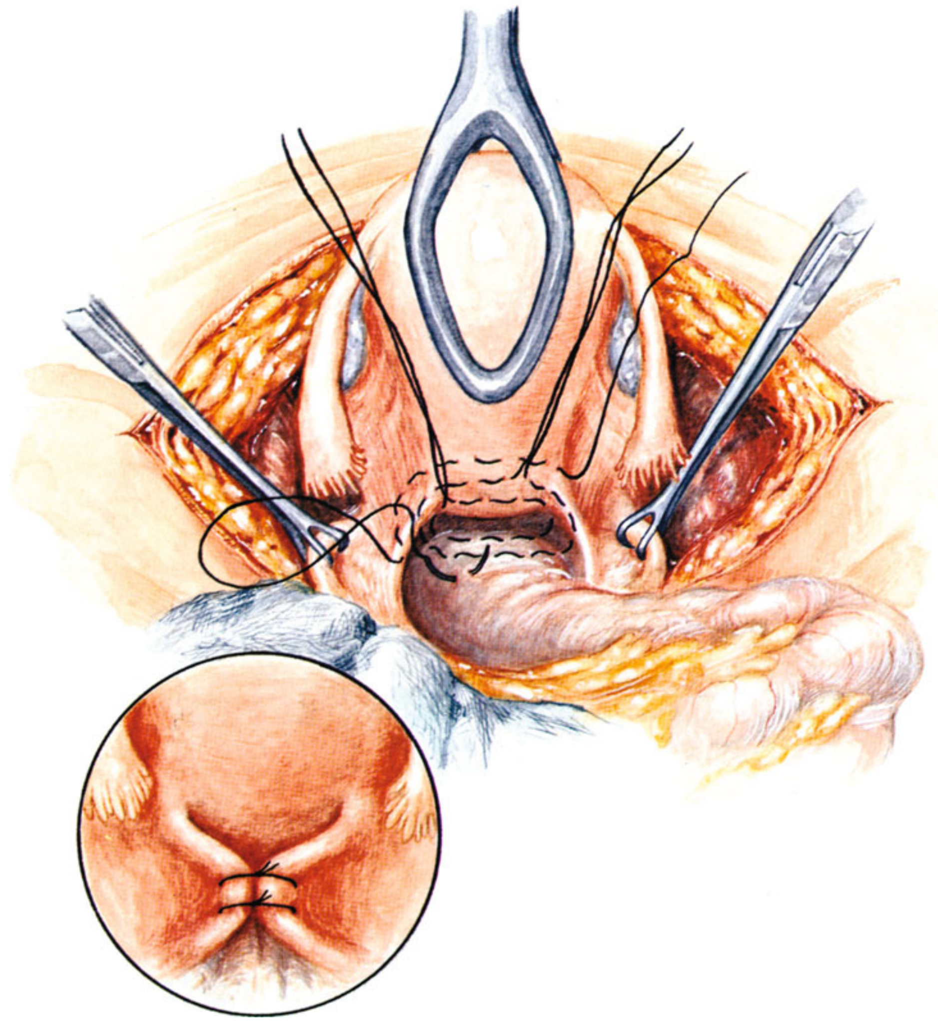


FIGURE 8-11. The Moschcowitz procedure for prophylactic repair of enterocele is useful in those patients in whom the uterus is to remain in place and a deep cul-de-sac is present. A nonabsorbable suture is placed in concentric circles beginning at the deepest portions of the cul-de-sac. Use a swedged-on round needle. As the upper portion of the cul-de-sac is approached, sutures should include a bite of the posterior uterus through the uterosacral ligaments, the anterior surface of the colon, and the opposite uterosacral ligament; tie the sutures in the midline. The ureters lie lateral to the uterosacral ligaments and must be carefully identified. A Babcock clamp is placed loosely about the ureters for additional safety. *Inset:* If the uterosacral ligaments are very mobile, bring them to the center of the midline to strengthen the repair.

Postoperative Management and Results

Postoperatively, patients are placed on long-term estrogens, particularly if the uterus is removed, to strengthen the endopelvic supportive structures and to produce a more pliable vaginal vault. Although some authors[11] suggest that patients remain in bed for 1 week following surgery, the author has the patient out of bed the day after surgery. It makes little sense to keep a patient in bed when studies on hernia repair have clearly shown that the results are not worse with early ambulation.

There are no data in the recent literature comparing the different types of enterocele repair and their results. Note that evaluation of the results in pelvic defects requires at least a 5-year follow-up. Most of the repairs look good in the first 6 months following surgery, but the final success depends on the ability of the patient to withstand the effects of aging and further pressure upon the operative site.

References

1. Folsome CE, Napp EE, Tanz A: Pelvic findings in the elderly institutionalized female patient. *JAMA* 1956; 161:1447–1454.
2. Fox WP: Vaginal evisceration. *Obstet Gynecol* 1977; 50:223–224.
3. Holland JB: Enterocele and prolapse of the vaginal vault. *Clin Obstet Gynecol* 1972; 155:1145–1154.
4. Hunter RE, Jahadi MR, Chandler JP: Spontaneous rupture of enterocele: Report of a case. *Obstet Gynecol* 1970; 36:835–839.
5. Kuhn RJP, Hollyock VE: Observations on the anatomy of the rectovaginal pouch and septum. *Obstet Gynecol* 1982; 59:445–447.
6. McCall ML: Posterior culdoplasty: Surgical correction of enterocele during vaginal hysterectomy; a preliminary report. *Obstet Gynecol* 1957; 10:595–602.
7. Milley PS, Nichols DH: Correlative investigation of the human rectovaginal septum. *Anat Record* 1969; 163:443–452.
8. Moschcowitz AV: The pathogenesis, anatomy, and cure of prolapse of the rectum. *Surg Gynecol Obstet* 1912; 15:7–21.
9. Peacock EE, Van Winkle W: Healing and repair of viscera, in *Wound Repair.* Philadelphia, Saunders, 1976, ch 12.
10. Pratt JH: Operative and postoperative difficulties of vaginal hysterectomy. *Obstet Gynecol* 1963; 21:221–226.
11. TeLinde RW: Prolapse of the uterus and allied conditions. *Am J Obstet Gynecol* 1966; 94:444–463.
12. Waters EG: Enterocele: Cause, diagnosis, and treatment. *Clin Obstet Gynecol* 1961; 4:186–198.

9 Repair of Rectocele and Perineum

As a result of the increasing popularity of cosmetic surgery, gynecologists are sought for plastic repair of pelvic relaxation brought on by the aging process. Among the changes brought on are mild changes in perineal muscular tone, minimal degrees of pelvic relaxation, and minor changes in the appearance of the lower genital tract. A majority of the defects are best managed by observation.

Patients also present with specific sexual complaints that are rarely due to isolated changes in the perineum and are generally handled through sexual counseling. If the patient insists on a surgical repair, write a statement in the patient's record indicating that the patient understands that the surgical repair may not correct the sexual complaint.

Severe and symptomatic abnormalities in pelvic visceral support do merit operative intervention. This procedure must be carefully designed for the defect, incorporating existing structures into a new supporting framework.

Anatomy

The condensation of endopelvic fascia extends downward between the vagina and rectum. These tissues thicken laterally and extend upward to be continuous with the uterus and ligaments and lateral to the cardinal ligaments. Take care to avoid dissecting the hemorrhoidal plexus of veins, which may be quite large near the lateral rectum.

Rectoceles are described as high, mid, or low in location, but more frequently a varying combination of these defects is diagnosed. The rectoceles are classified as mild if they extend to the introitus on examination, moderate if they extend out the hymenal ring with straining, and severe if the defect extends through the hymen without straining.[5]

Preoperative Evaluation

A careful and precise clinical study by Gainey clearly documented the effect of childbirth in perineal relaxation and the effect of episiotomy in preventing pelvic defects.[1,2] Note that the defect is related more to the occurrence of childbirth than to the number of deliveries and is not necessarily cumulative in its effect.[6] Relaxed introitus has little effect on rectocele or uterine prolapse, nor does it prevent vault prolapse. Do not repair such defects by perineorrhaphy without a careful and thorough dissection involving repair of the perirectal fascia.[3]

The patient is evaluated in the office by means of a simple rectovaginal examination. The patient should not be anesthetized during the evaluation of perineal relaxation.

To diagnose the presence of associated enterocele and high rectocele, use a narrow speculum placed transversely during the rectovaginal examination. The introitus normally accommodates two fingers, the index and middle fingers, with the patient awake. When the patient contracts the vaginal muscles the fingers should fit snugly in the introitus; however, an introitus that accommodates three fingers without symptoms needs no repair.

Avoid the plastic repair of nonsymptomatic pelvic relaxation as there is a high incidence of sexual dysfunction after vaginal plastic repairs. Jeffcoate reports that 30% of patients have sexual dysfunction after anterior and posterior colporrhaphy.[3] These procedures are a poor choice when the anatomic defect is minimal and the psychosexual element prominent.

If the patient is menopausal, preoperative oral estrogen (1.25 mg conjugated estrogens) for 6 weeks prior to surgery will increase the vaginal blood supply, the vaginal tone, and the strength of paravaginal supportive structures. If the patient has a combined prolapse with some inflammatory changes, a cream combining topical estrogens and sulfa is applied locally; the patient may mix commercially available preparations half and half.

A barium enema and proctoscopy are necessary to rule out gastrointestinal pathologic abnormalities that produce straining at stool. Note that the number of carcinomas of the colon being found in the right colon is increasing and that barium enema is an integral part of evaluation of these patients. The presence of dysfunctional bowel syndrome has been associated with very poor results and may be a relative contraindication to this operation.[6] Patients have both a mechanical and an antibiotic bowel preparation according to the table in Chapter 22.

Operative Technique

Basic rectocele repair is illustrated in Figs. 9-1 through 9-4. Patients who have a high rectocele repair in association with vaginal hysterectomy will have a continuous suture line from the hysterectomy site incorporating the uterosacral ligaments down to the perineal body. It is important to close any enterocele sac with fixation of the sac to the uterosacral ligament with permanent suture such as braided nylon. If the perirectal fascia is well formed, a second suture line may be used to bring it to the midline (Fig. 9-3).

Midrectoceles may require imbrication (Fig. 9-3), with the perirectal fascia pulled over the imbrication.

Low rectoceles are usually associated with significant perineal relaxation; close by approaching the rectocele through a transverse incision, inverting the mucosa, and pulling the perirectal fascia medially, including the levator muscles in a separate layer.

Take great care to avoid any rigid transverse scar tissue during perineorrhaphy. Fashion a vaginal opening that easily admits two fingers. Remember that the patient is asleep, often with muscle relaxants, and has little of her normal perineal tone. If it is determined that vaginal dimensions have been compromised by the surgical procedure, lateral relaxing incisions may be performed according to the technique described by Nichols.[4] Introital stricture can be relieved through use of a Z-plasty as described in Chapter 14.

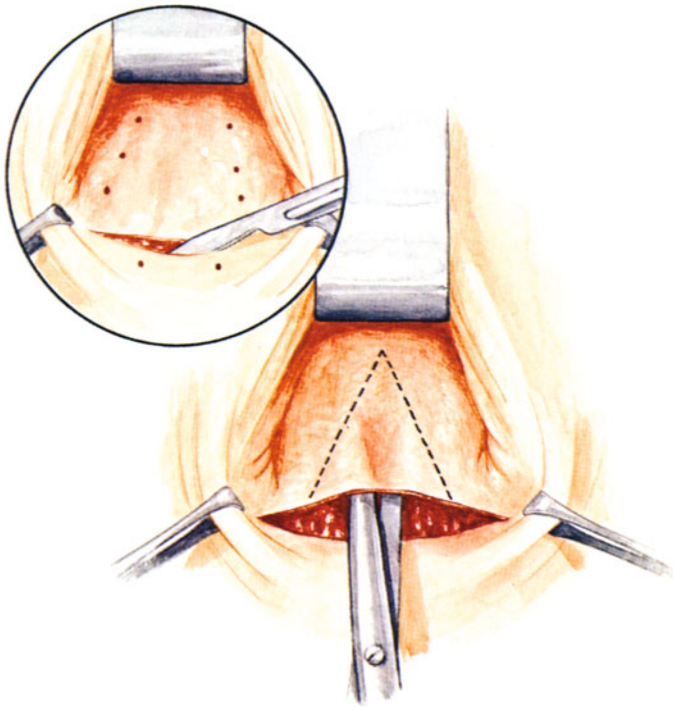


FIGURE 9-1. Inject the introitus and rectovaginal septum with a dilute solution of phenylephrine (Neo-Synephrine); make a transverse incision at the introitus and carry it across to the opposite side of the vagina (*inset*). Do not incise up the vagina if the rectocele is low and the vaginal epithelium mobile. If, however, the vaginal epithelium is quite redundant, make a V-excision of epithelium.

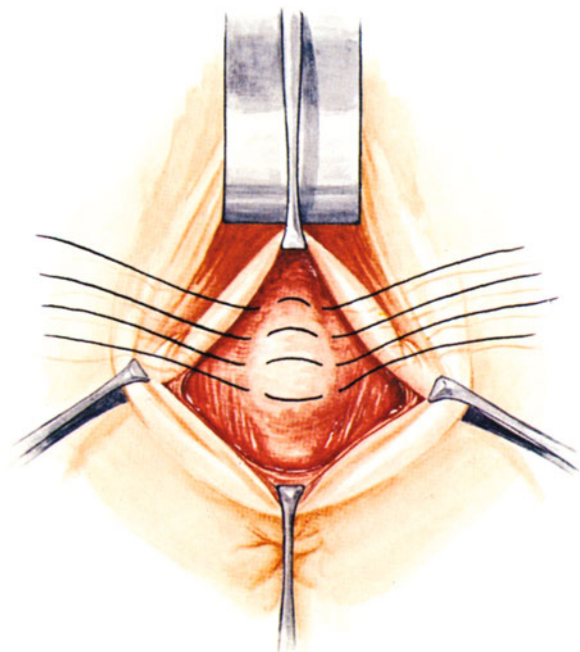


FIGURE 9-2. Dissect the vagina free of the rectum and extend the plane to the perirectal fascia. With a large rectocele the perirectal fascia may be absent in the midline and the lateral perirectal fascia must be approximated for effective repair. The hemorrhoidal veins are more prominent inferiorly and laterally; avoid them when possible. Imbricate the rectum with interrupted sutures of 2–0 or 3–0 absorbable suture. Approximate large portions of perirectal fascia to reinforce the repair.

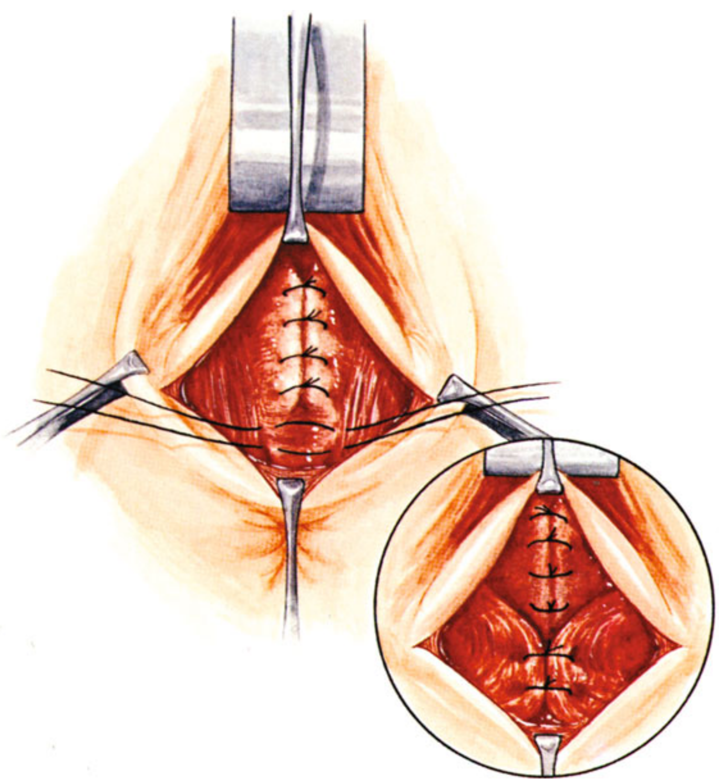


FIGURE 9-3. After reducing the rectocele and bringing the perirectal tissues to the midline, use the levator muscles to strengthen the incision. Pass a suture of 0 chromic gut on a large general closure needle lateral into the lower portions of the levator muscles, bringing them to the midline. This procedure is reserved for the older patient with a large rectocele as introital stricture may result if one employs too aggressive a mobilization of the levators and their suture in the midline. Close the skin incision by approximating the vaginal epithelium with interrupted 3–0 absorbable suture. Drains and packs are not necessary. A Foley catheter is not necessary in the rectocele repair alone.

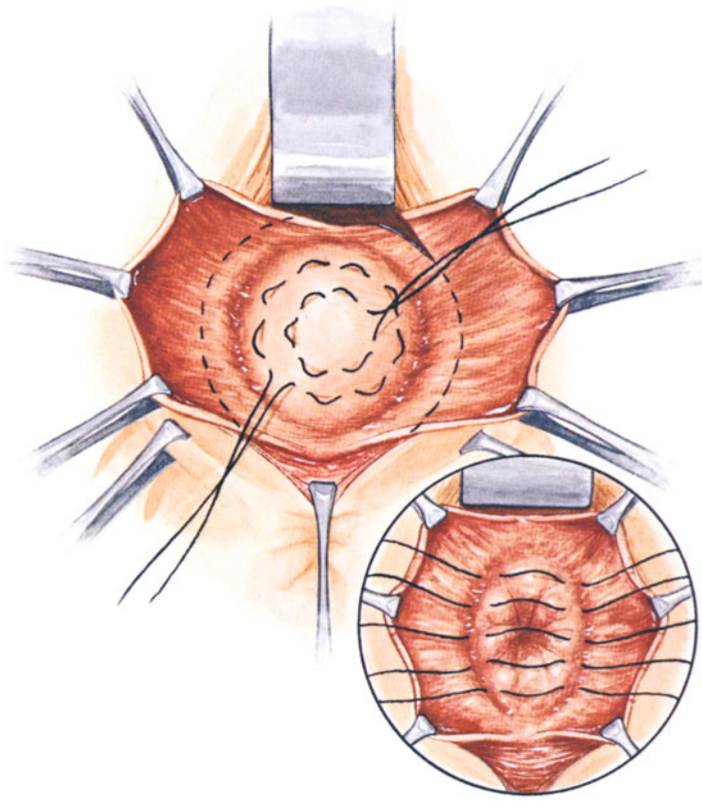


FIGURE 9-4. If a large rectocele is present, imbricate it with concentric rings of 2–0 absorbable suture. After bringing in the large central portion of the rectocele, imbricate the outer margins of the ring with interrupted sutures to include the perirectal fascia. Excise the redundant vaginal epithelium. Take care in the excision of any vaginal epithelium in the young, sexually active patient and avoid any introital stricture through careful planning of the rectocele incision.

Postoperative Management

If the patient has a simple rectocele repair, vaginal packs and bladder catheters are not necessary. In the patient with associated pelvic repairs, use a vaginal pack for 24 hours and insert a Foley catheter for straight drainage. When the Foley catheter is removed, place the patient on a urinary antiseptic such as nitrofurantoin macrocrystals (Macrodantin).

Because of the healing curve of bowel, fibrous tissue and fascia, rectocele patients require at least 6 weeks postoperatively to regain strength in the rectal area; thus, stool softeners are ordered in the immediate postoperative period and are continued for 3 months.

Further postoperative measures include sitz baths and estrogen creams, supplemented with oral estrogens if the patient has an atrophic vaginal mucosa. Intercourse may be resumed in 6 weeks. A long-term change in diet and bowel habits is recommended for the prevention of future rectoceles and defects in the lower genital tract associated with straining.

References

1. Gainey HL: Post-partum observation of pelvic tissue damage. *Am J Obstet Gynecol* 1943; 45:457–466.
2. Gainey HL: Postpartum observation of pelvic tissue damage: Further studies. *Am J Obstet Gynecol* 1955; 70:800–807.

3. Jeffcoate TNA: Posterior colpoperineorrhaphy. *Am J Obstet Gynecol* 1959; 77:490–502.
4. Nichols DH: Vagina is too narrow and tight for marital comfort at completion of vaginal hysterectomy and repair, in Nichols DH (ed): *Clinical Problems, Injuries and Complications of Gynecologic surgery.* Baltimore, Williams and Wilkins 1983, ch 24.
5. Porges RF: A practical system of diagnosis and classification of pelvic relaxations. *Surg Gynecol Obstet* 1963; 117:769–773.
6. Pratt JH: Surgical repair of rectocele and perineal lacerations. *Clin Obstet Gynecol* 1972; 15:1160–1172.

Anterior Colporrhaphy

10

Anterior colporrhaphy is a common operation in gynecologic surgery. Although originally employed for stress incontinence alone, retropubic procedures are currently used to correct stress incontinence. In modern gynecologic surgery anterior colporrhaphy is performed primarily for prolapse of the anterior vaginal wall and secondarily for stress incontinence.

Anatomy

The anterior repair is an operation that utilizes as its plane of dissection the junction between the vaginal smooth muscle and the bladder muscularis. The anterior vaginal wall consists of vaginal mucosa, smooth muscle of the vagina, associated blood vessels, bladder muscularis, and transitional epithelium of the bladder. This plane is an artificial one and is made possible only through the effective use of strong traction on both sides of the dissecting field maintained in a planar fashion.

The anatomic relationships of significance are those of the arteries coursing laterally along the vagina and joining in arcades. The venous plexuses surrounding the bulbocavernosus muscle join near the pelvic floor and are continuous with those of the urethra and the venous plexus of the bladder. As these lie laterally, initial dissection is best conducted in the midline. A larger field is exposed before lateral dissection is performed so that hemostasis can be secured more easily. The precise histologic character of the tissue between the bladder and vagina has been subject to considerable debate. It appears to vary from predominantly smooth muscle in the younger patient to a more fibrous tissue in the elderly. These tissues are quite sensitive to estrogen; therefore, if the patient has atrophic vaginal tissues preoperative estrogen administration is recommended.

Preoperative Evaluation

The indication for anterior colporrhaphy is a large cystocele or moderate cystocele with stress incontinence. There is little indication in modern operative planning for anterior colporrhaphy as a prophylactic measure (as a trial repair for stress incontinence, with an abdominal procedure planned later should failure occur) or as a procedure for stress incontinence when little relaxation exists.

The assessment of coexistent cystocele and stress incontinence includes the following: a detailed history and physical examination; laboratory studies to rule out neurologic diseases; an evaluation of vesical neck support and anal and vaginal sphincter tone; the measurement of residual urine, urinalysis, and culture; the demonstration of incontinence with its relief by paraurethral compression; urethroscopic examination employing carbon dioxide urethroscopy; pressure measurements; and notations of urethral mobilization by manipulation such as the Q-tip test. Details of the evaluation of stress incontinence are found in Chapter 24.

While a vast number of abnormalities are associated with urinary incontinence, the following categories can be outlined: urge incontinence accompanying urethritis, trigonitis, or cystitis of infectious, atrophic, or psychosomatic origin; bladder neuropathy caused by lesions of the central or peripheral nerves, encompassing most of the disorders of the nervous system; congenital or acquired urinary tract anomalies such as ectopic ureters, urethral diverticula, postoperative scarring, and strictures and fistulas; and detrusor dyssynergia.[3] Careful study of the latter lesion by Hodgkinson and his colleagues revealed that increased intra-abdominal pressure may produce sudden uninhibited detrusor contractions, thereby producing actual voiding rather than a leaking type of anatomic incontinence.[4] This confuses the diagnosis, as both events are precipitated by increased abdominal pressure.

Of all patients complaining of abnormal urinary leakage, 85% have a history of stress incontinence.[3] Of this group, 90% to 95% have true anatomic stress incontinence, and 5% to 10% suffer from a condition other than anatomic stress incontinence. A trial of anticholinergics may be worthwhile in the latter group of patients; most will respond, further documenting that surgery is not indicated. If the patient has true anatomic stress incontinence in the absence of marked anatomic defects of the vagina, the procedure of choice is the urethral suspension.

If the cystocele is of moderate size, anterior colporrhaphy may be accomplished during hysterectomy, with the cystocele repair done as described in Chapter 15. Abdominal repair is adequate for small to moderate size cystoceles. When associated with urethral suspension, it produces good support of the defect in the anterior vaginal wall.[6] If undecided on which route to take, the surgeon should err on the side of suprapubic procedures. Low showed a failure rate of 42% in patients with minimal descensus when repaired vaginally.[5] Morgan noted that the 5-year success rate for anterior repair was 50% for stress incontinence, whereas suprapubic methods yielded an 80% success rate.[7]

Finally, remember that stress incontinence is not an emergency and that the presence of a cystocele does not rule out the simultaneous occurrence of one or more of the factors noted in stress incontinence. Careful preoperative evaluation with a therapeutic trial, if indicated, of anticholenergics, antibiotics to sterilize the urine, estrogens to relieve trigonitis, and office discussion and appropriate referral if psychosomatic symptoms exist are necessary. If the cystocele is symptomatic but other factors are present, the patient should be advised that the repair of her cystocele, when large enough to warrant independent surgery, may not necessarily relieve her other urinary symptoms.

Operative Technique

The patient is placed in the lithotomy position and prepared in the usual manner. The surgical procedure is illustrated in Figs. 10-1 through 10-3.

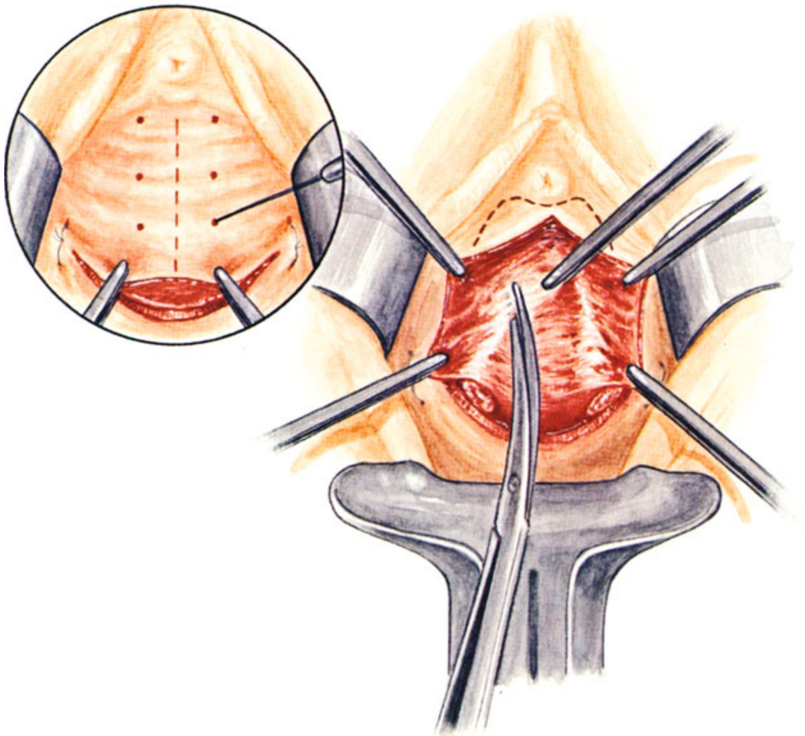


FIGURE 10-1. Anterior repair is performed independently or in conjunction with vaginal hysterectomy. Inject the space between the vagina and bladder muscularis with a dilute vasoconstrictor solution. Be sure to include the lateral paraurethral tissues and vagina. Using fine scissors with a very slightly rounded point and pulling downward on the vaginal mucosa, dissect between the bladder and vagina in a straight line toward the urethra. Using the scissors, follow the dotted line to where no cleavage plane exists between the urethra and vagina.

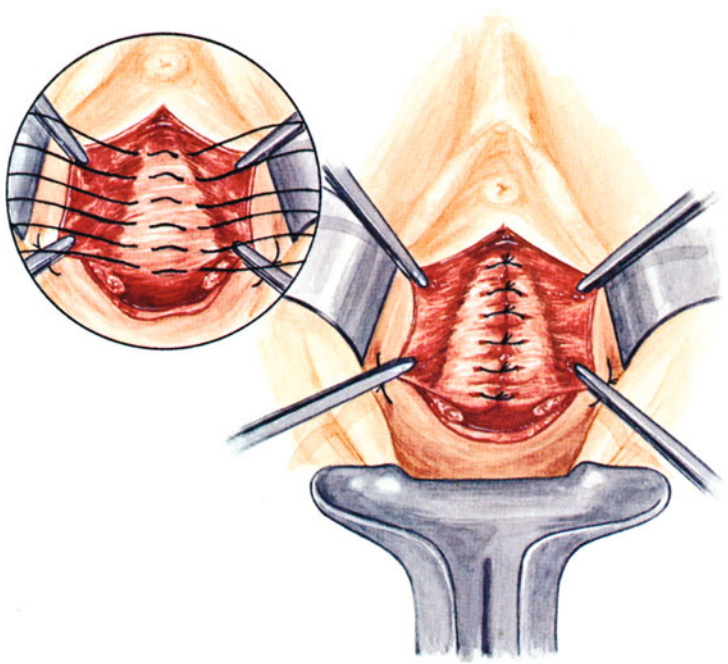


FIGURE 10-2. Have the assistant grasp the lateral vaginal margin with Allis Adair clamps or Adson-Brown thumb forceps and pull laterally and caudad. Grasp the tissue to be dissected with Adson-Brown thumb forceps and pull directly away from the vagina. Using fine sharp scissors, dissect between the bladder and vagina in the loose areolar tissue that lies in this area. Strong traction and countertraction will produce a plane that allows dissection upward. Continue the dissection upward and laterally near the urethra. Dissect the opposite side in a similar fashion. The bladder should be free of the vaginal wall in its mid and lateral portions. Small bleeders should be suture ligated with 3–0 or 4–0 absorbable suture.

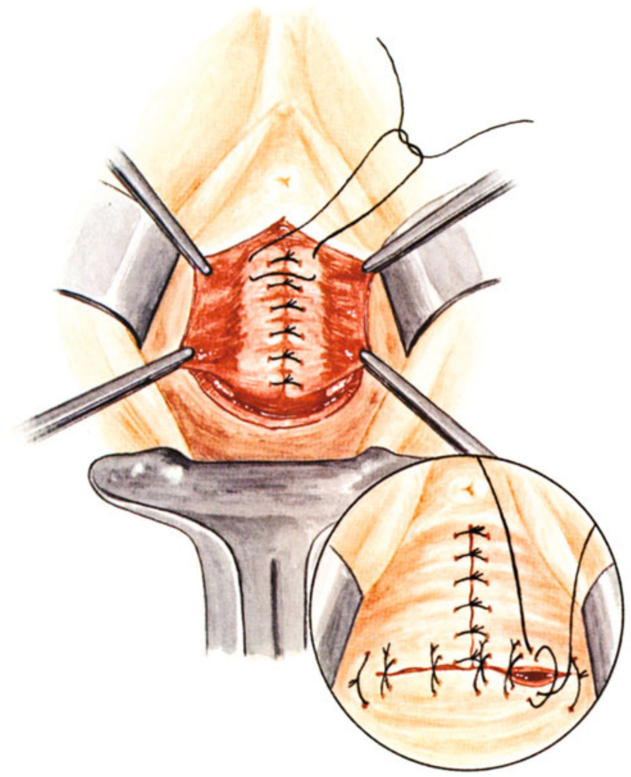


FIGURE 10-3. In older patients the central bladder may be quite atrophic and large, in which instance a single or double purse-string suture may be used to imbricate the large bulging central portion of the cystocele. When the defect is more modest, as illustrated, place 2–0 absorbable imbricating sutures to pull the midportion of the bladder upward. Place a layer of 2–0 absorbable suture at the lateral margins of the previous row and bring them together, tying them just lateral to the midline. Place an upward suture laterally at the margins where the dissection extended (dotted lines) and tie one or two of these sutures to support the urethra. Do not elevate the base of the bladder excessively where the urethral vesical neck cannot be well supported as incontinence results. Trim any redundant vaginal mucosa. Close the vagina with 3–0 absorbable suture using simple sutures in the vertical portion. Incorporate the anterior vaginal wall in the vaginal hysterectomy closure after the cardinal ligaments have been sutured to the angles of the vault with far-and-near 3–0 absorbable closure. Place a 2-inch Iodoform vaginal pack in the patient as well as a Foley catheter.

Postoperative Management and Results

Patients with cystocele repair alone are promptly allowed to ambulate and are placed on a regular diet as tolerated. The vaginal pack placed during the procedure is removed on the second postoperative day.

Although the author was an early advocate of the various suprapubic methods of draining the bladder, the disappearance of the ward nurse who personally took an interest in maintenance of such suprapubic devices caused the author to return to the time-honored Foley catheter. The catheter is left in place for four days. Following removal of the catheter, the patient is allowed to void. If the residual urine is greater than 125 mL, the Foley catheter is replaced and removed the following day. Catheterization for residual urine measurement should be carefully performed. New suture lines are easily perforated. Beck noted three urethral fistula due to traumatic catheterization.[2] As soon as the catheter is removed, the patient is given sulfisoxazole or nitrofurantoin for 10 days. As soon as the patient is voiding properly, she is dismissed with instructions to void at no longer than two-hour intervals during the day and to force fluids. A urine culture is obtained when the patient is seen in the office after 6 weeks. Less than 5% of patients following this regimen have a positive urine culture. In addition, the patient is cautioned against intercourse and heavy lifting for 6 weeks.

Approximately 10% of patients have a recurrent cystocele; most are elderly patients with recurrence due to the general relaxation of pelvic tissues. For this reason more aggressive repair of cystocele is undertaken in the elderly. In the younger or premenopausal patient more moderate dissection is performed to avoid dyspareunia, and mucosa is rarely excised. Simmons has called attention to an increased incidence of dyspareunia following anterior vaginal prolapse repairs.[8] The success rate of anterior colporrhaphy, based on patients' subjective evaluations, is approximately 60%.[1] Using stringent criteria, Beck reports an 80% success rate with anterior colporrhaphy.[2] By suturing beneath the symphysis, he actually performs a vaginal retropubic suspension. Longer-term observation of this technique is needed to determine its continuing effectiveness. Beck's series is particularly valuable since he personally performed the surgeries on these patients over a 16-year period.

References

1. Arnold EP, Webster JR, Loose H, et al: Urodynamics of female incontinence: Factors influencing the results of surgery. *Am J Obstet Gynecol* 1973; 117:805–812.
2. Beck RP, McCormick S: Treatment of urinary stress incontinence with anterior colporrhaphy. *Obstet Gynecol* 1982; 59:269–274.
3. Green TH: Urinary stress incontinence: Differential diagnosis, pathophysiology, and management. *Am J Obstet Gynecol* 1975; 122:368–400.
4. Hodgkinson CP: Relationships of the female urethra and bladder in urinary stress incontinence. *Am J Obstet Gynecol* 1953; 65:560–573.
5. Low JA: Management of anatomic urinary incontinence by vaginal repair. *Am J Obstet Gynecol* 1967; 97:308–315.
6. Macer GA: Transabdominal repair of cystocele, a 20-year experience, compared with the traditional vaginal approach. *Am J Obstet Gynecol* 1978; 131:203–207.
7. Morgan JE, Farrow GA: Recurrent stress urinary incontinence in the female. *Br J Urol* 1977; 49:37–42.
8. Simmons SC: Dyspareunia following repair—"The skin bridge" and its prevention. *J Obstet Gynaecol Br Comm* 1963; 70:476–478.

11 Vaginal Prolapse

There are at least 43 well-documented descriptions of surgical procedures designed to repair vaginal vault prolapse.[9] Vaginal vault prolapse is a result of an inherent weakness in the vaginal supporting structures (uterosacral and lower portion of the cardinal ligaments). Trauma from childbirth, obesity, postmenopausal atrophy, and unsatisfactory healing of the supporting structures following vaginal or abdominal hysterectomy are contributory factors.

Anatomy

At one time the suspension of the vagina to the anterior abdominal wall, round ligaments, or pubic symphysis was advocated; however, studies by Berglas and Rubin published in 1953 clarified the importance of the vaginal axis and its horizontal relationship to the ground with the patient in the erect position.[2] The long axis of the vagina points toward the hollow of the sacrum, not directly upward toward the symphysis nor toward the sacral promontory. In this position, the vagina is supported by the posterior levator plate as shown in Fig. 11-1. Procedures that restore this more posterior axis of the vagina are therefore more likely to be effective over the long period of observation needed to determine the success rate of such procedures. Although Beecham and Beecham and others have achieved good results with anterior fixation, their good results were more likely due to superior surgical technique and the use of a very strong fascial support rather than the inherent design of the procedure.[1] Langmade et al described excellent results in 85 cases of vaginal vault suspension using Cooper's ligament.[5] The ligament was detached and the vault suspended in midposition. They noted no postoperative stress incontinence.

Preoperative Evaluation

The patient presents with complaints of vaginal protrusion, difficulty in voiding or defecating, unsatisfactory coitus, or complaints referable to ulceration of the vaginal mucosa. Preoperative diagnostic studies include very careful palpation of the protrusion with rectovaginal examination to determine the rectocele component of the mass, cytologic study of the cervix and endometrium, cystoscopic examination, and intravenous pyelogram studies. Preoperative estrogen

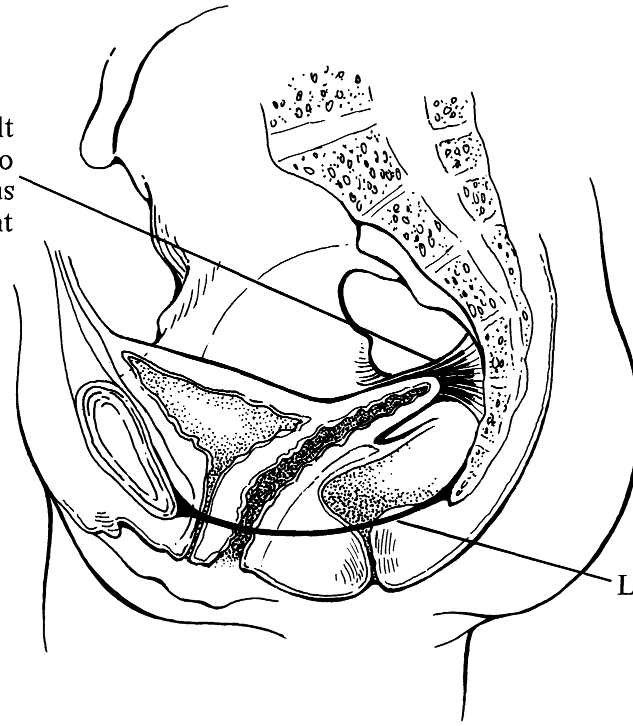


FIGURE 11-1 Note horizontal position of the vagina with sacrospinous fixation.

stimulation in the absence of any contraindication is begun to improve the quality and blood supply of the vaginal mucosa. Review the patient's sexual activity and anticipated results with the patient and her sexual partner and note this discussion in the medical record. When the procedure follows prior failed vaginal repair with scarring and foreshortening, abdominal sacropexy should be considered.

Operative Technique

Vaginal vault suspension procedures are either vaginal or abdominal in approach. The vaginal procedures include Symmonds repair (Fig. 11-2), sacrospinous fixation[7] (Figs. 11-3 and 11-4), and total vaginectomy. Abdominal procedures include posterior Birnbaum sacropexy,[8] (Figs. 11-5 and 11-6) and Moschcowitz-type excision and repair of the cul-de-sac.

Vaginectomy, although the most secure repair, renders intercourse impossible. This is the procedure of choice when the defects are large, the patient is elderly, and prior surgical repair has failed (Figs. 11-7 through 11-10). Such patients may develop perineal hernias after total vaginectomy. Be alert for connective tissue disorders in this group of patients.

Jeffcoate[4] and Simmons[10] reported a 50% incidence of dyspareunia and apareunia following anterior and posterior repair; therefore, avoid the posterior repair and use an abdominal or vault suspension to produce satisfactory sexual function.

For the patient undergoing vaginal suspension with Dacron graft, administer preoperative antibiotics prior to the placement of this prosthesis; advise the patient of the definite incidence of prosthesis sloughing and removal (Fig. 11-5).

Many authors describe the use of silk suture with prostheses. Silk suture loses its strength in tissue; Dacron (which is the same substance as the graft) is much stronger and more permanent.

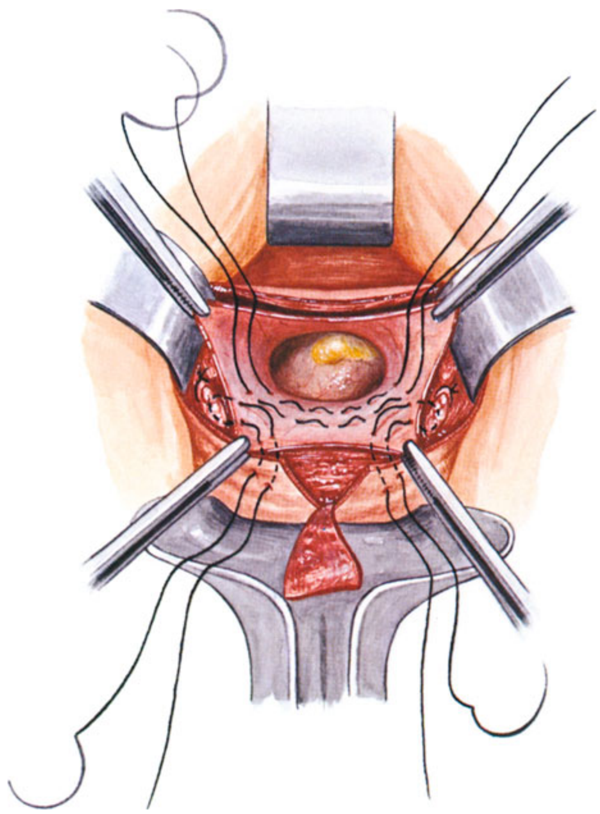


FIGURE 11-2. Symmonds vaginal vault prolapse repair after the completion of vaginal hysterectomy. If the uterus has previously been removed, isolate the associated enterocele sac (Chapter 8). Dissect the sac free and excise it. Excise a wide wedge of posterior vaginal wall as shown. Place a series of 2–0 absorbable sutures through the vaginal wall, up over the sac, and into the high uterosacral and cardinal ligaments. Bring these down and exit through the vaginal wall. Make certain the upper sutures are placed as high as possible in the uterosacral ligaments. Elevate the margin of the vault and tie the sutures from above downward. Close any defect left in the sac with 2–0 purse-string absorbable sutures. This will produce a solid wedge of tissue in the upper posterior vaginal wall. Close the vagina as in vaginal hysterectomy by securing the cardinals laterally and closing the vagina with far-and-near 3–0 sutures. Close any defect in the vaginal wedge with 3–0 far-and-near sutures. Any posterior repair should continue up to the wedge excision. Anterior repair can be performed in the usual fashion if indicated. Place a Foley catheter and lodoform vaginal pack as in the usual vaginal repair.

FIGURE 11-4. When the operation is completed the vagina will be directed toward ▷ the patient's right and firmly attached to the ligament. Note again how close the anterior most suture lies to the artery and the nerve. Care in suture placement and good vaginal approximation is the essence of success with this operation.

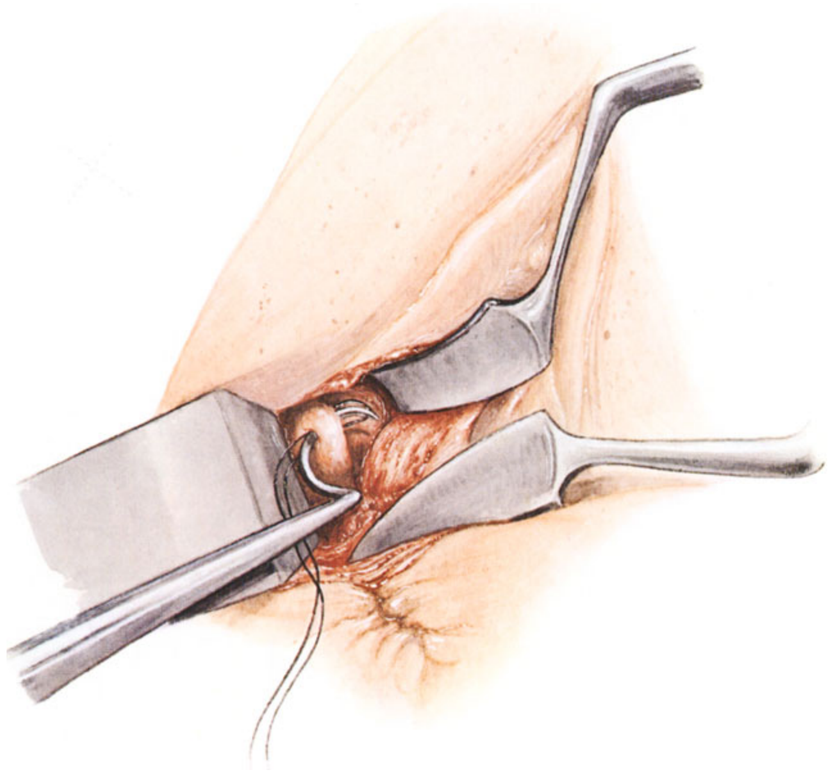
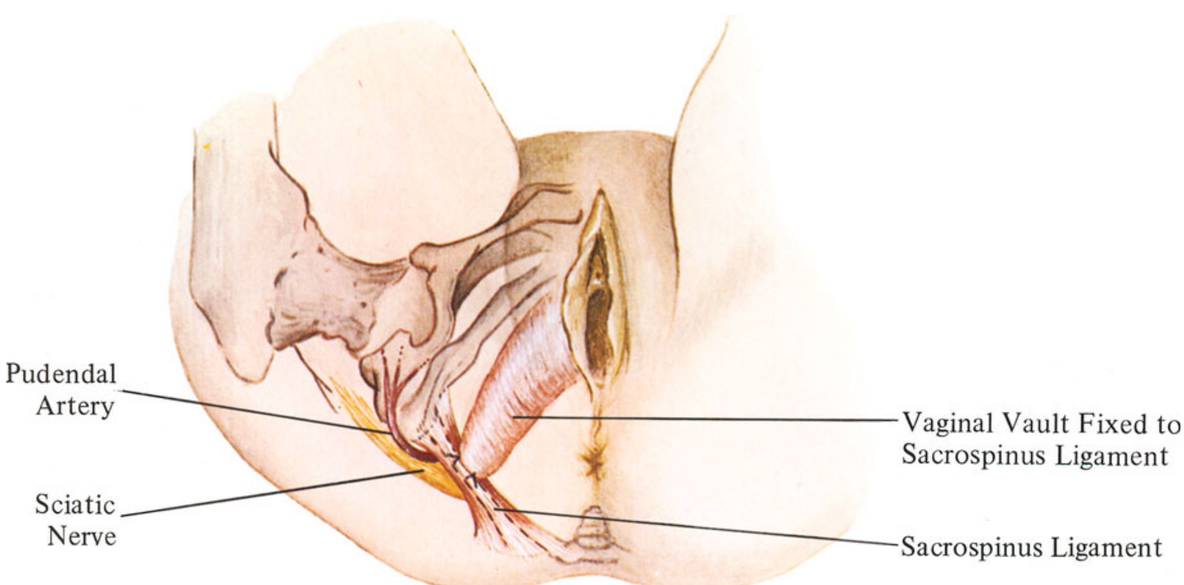


FIGURE 11-3. Make a V-shaped perineal incision with subsequent reflection of the posterior vaginal wall until the avascular rectovaginal space is identified. Develop this space to the vaginal apex and, if an enterocele sac is identified, resect and close with high, purse-string peritonealization. Using the right index finger, palpate the right ischial spine through the developed rectovaginal space. Bluntly perforate the right rectal pillar and enter the right pararectal space. Insert a long Breisky-Navratil retractor to displace the rectum to the patient's left; a second retractor displaces the cardinal ligament and ureter anteriorly.

Push loose areolar tissue to one side and identify the superior surface of the coccygeus muscle posterolateral to the ischial spine. Using a Deschamps ligature carrier loaded with 0-gauge non-absorbable suture, penetrate the sacrospinous ligament 1½ to 2 fingerbreadths medial to the ischial spine. The ends of the suture are threaded onto a free needle and sewn to the undersurface of the vaginal vault. Tie these sutures after the upper portion of the posterior colporrhaphy incision is repaired. The vaginal apex should be attached to the sacrospinous ligament by direct contiguity, leaving no suture bridge. Complete the posterior colporrhaphy and lightly pack the vagina with Iodoform gauze. Remove packing and catheter the day following surgery.



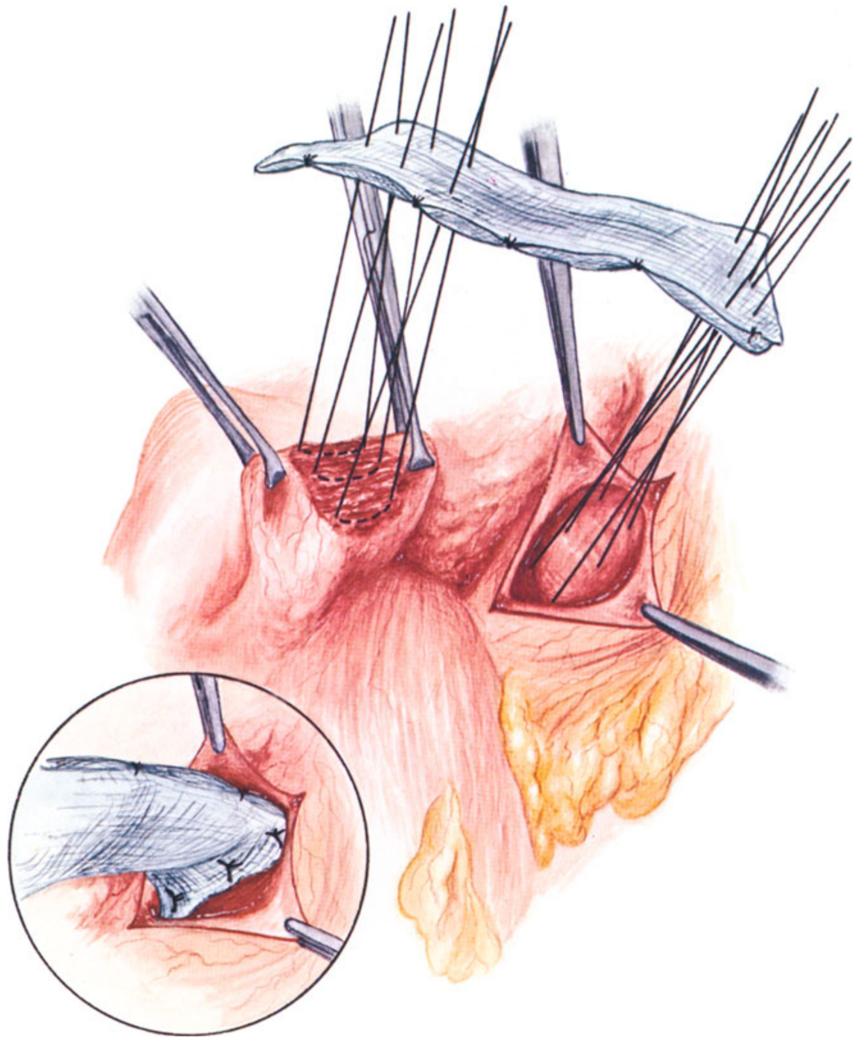


FIGURE 11-5 Sacropexy: the Birnbaum technique. Perform any needed vaginal repair of cytocele and rectocele. Place two long Allis clamps on the vaginal cuff. Prepare the abdomen and place the patient in the low lithotomy position. Open the abdomen with sufficient exposure to see the upper sacrum. Pack the abdomen and 5 cm below the sacrum incise for 4 to 5 cm. Stay medial to the ureter and avoid the gluteal vessels and the small sacral veins. *Inset:* Place three sutures through the double layer of Dacron mesh and through the presacral fascia and periosteum and out again through the graft. Use 3–0 Dacron in a nontraumatic needle. Identify the vaginal vault by manipulating and palpating the Allis clamps previously placed on the vaginal vault. Dissect the bladder off the vagina if it has been oversewn in prior surgery. Again lay the mesh over the vagina and adjust the tension by pulling the graft into its ultimate sacral position. Suture through one side of the mesh, into vaginal muscularis, and out again through the graft. Be certain not to enter the vaginal epithelium. Place three sutures approximately 1 cm apart and tie the vaginal sutures.

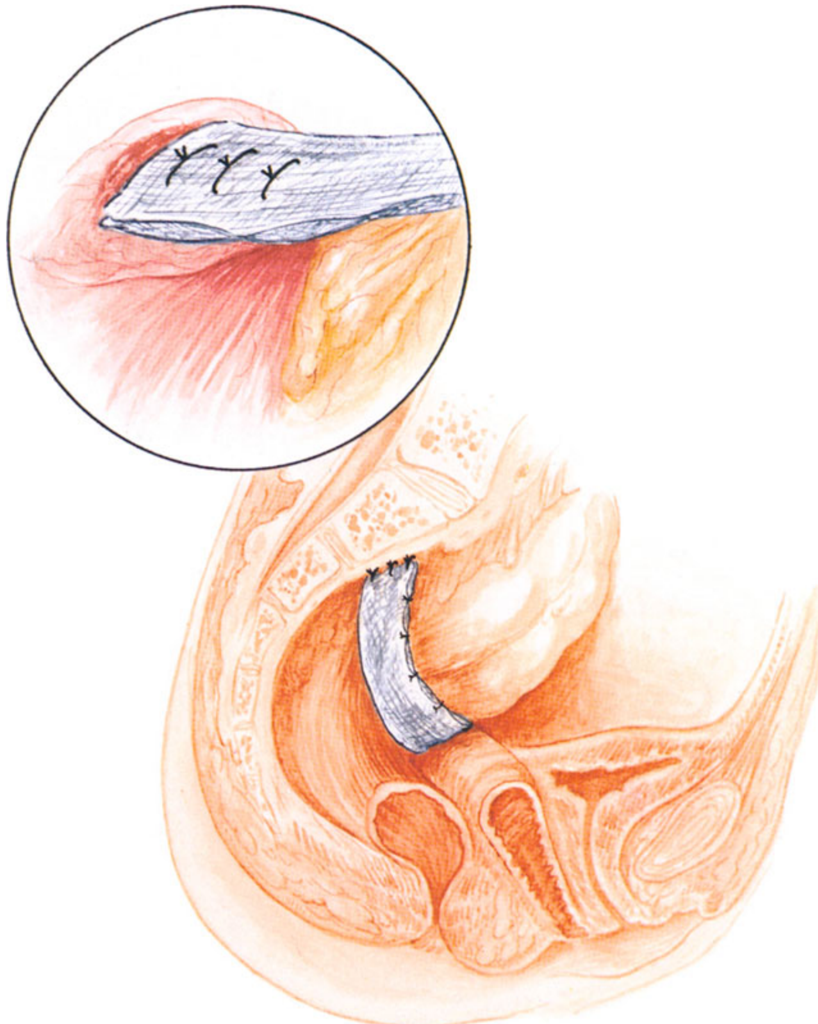


FIGURE 11-6. Tie the sacral sutures, pulling the vagina into position (*inset*). Suture the serosa over the mesh and approximate the serosa of the sigmoid to avoid internal hernia.

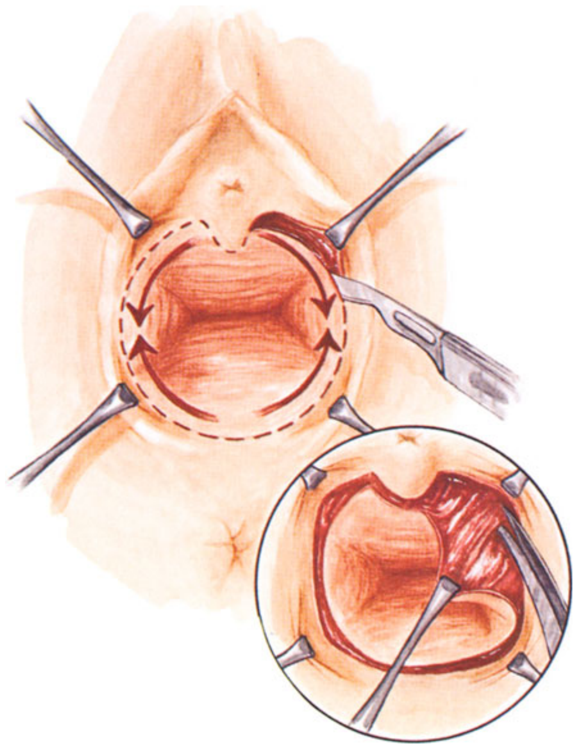


FIGURE 11-7. Infiltrate the perivaginal tissues in the area of the introitus with a dilute solution of phenylephrine (Neo-Synephrine). Make a sharp incision about the introitus. Leave 2 cm beneath the urethra to minimize stress incontinence. If the excision is for carcinoma in situ, note the location of the lesion prior to excision. With sharp downward traction, begin the dissection in the anterior and posterior repair planes and carry it laterally; continue the dissection to the vaginal cuff. The area of the cuff and lateral margins of the vagina will then remain adherent with strong traction at each of the margins. Cut these sharply. Clamp and tie bleeders with 3–0 absorbable suture. Note the close approximation of the anterior portion of the lateral vagina to the ureter during dissection. Have a clear view when tying bleeders so that the ureters are not included in any of the ties. Isolate and clamp the vaginal supporting tissues, which extend downward from the upper portions of the cardinal ligaments. Cut the area of the old hysterectomy cuff as well.

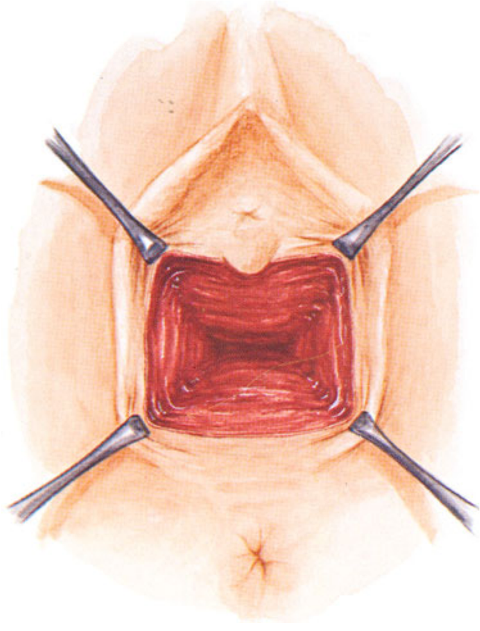


FIGURE 11-8. Following removal of the vaginal epithelium, isolate and tie small vessels. It may be necessary to place a vaginal pack or use Avitene sheets in the areas that are oozing.

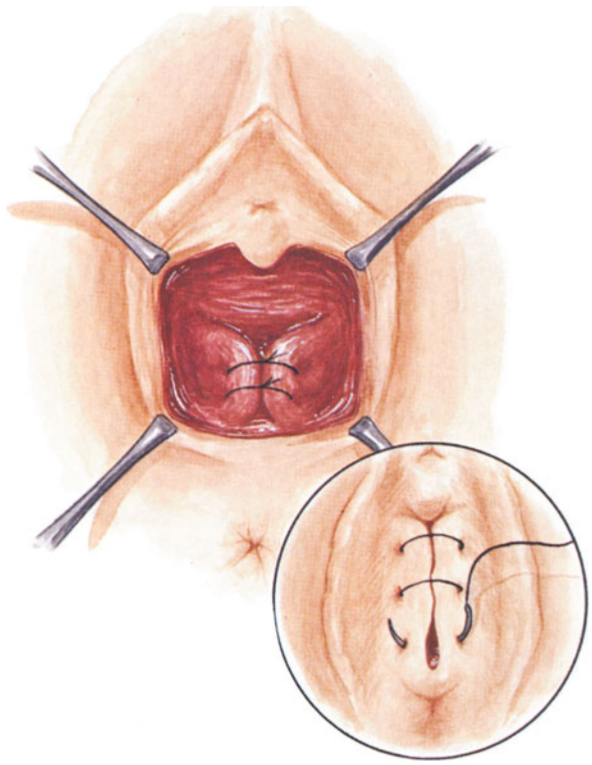


FIGURE 11-9. If vaginal function is not to be preserved, the levator muscles are simply sutured in the midline with 0 chromic suture and the introital skin is closed with interrupted 3–0 absorbable sutures. Any cystocele or rectocele of significance may be treated prior to the closure of the levator muscles in the absence of vaginal epithelium; however, recurrent prolapse is a rare problem. Cystoscope the patient immediately following the procedure and observe the passage of indigo carmine from each ureter.

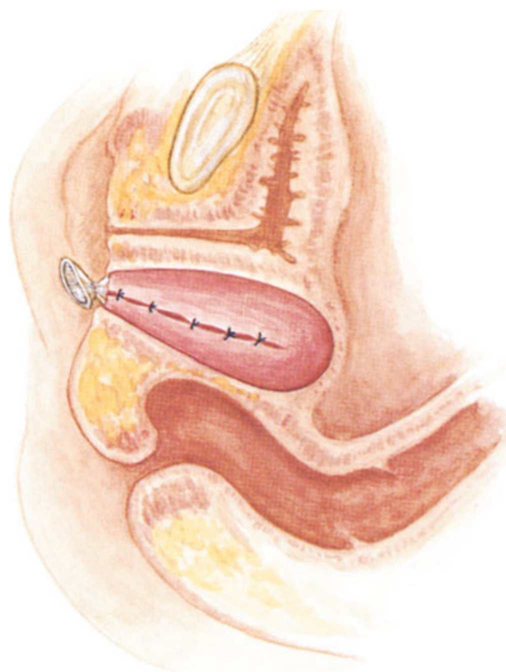


FIGURE 11-10. If total vaginectomy is to be performed for a neoplastic process and vaginal function preserved, proceed as shown in Figs. 11-7 and 11-8. Secure hemostasis and apply skin graft at this time. The graft is cut prior to the vaginectomy and is kept in saline-soaked sponges. The skin is cut with a Padget dermatome, which is excellent for this purpose. The epithelial surface is stretched over a foam rubber-filled condom, which is used to stent the skin in place in the vagina. The introitus is sutured over the stent. The stent is removed in 48 to 72 hours with a postoperative program of vaginal dilatation. When suturing the skin, be careful not to suture the skin to the condom, as the skin will be pulled out when the condom is removed. The skin margins are sutured to the introitus and excess skin is trimmed.

Postoperative Management and Results

Place a vaginal lodoform pack and Foley catheter in the patient. The Foley catheter may be removed in 48 hours; antibiotics are administered while the Foley catheter is in place and for three days following removal. The patient may be out of bed on the second postoperative day. Any rectocele or cystocele repair would require changes in procedure to accommodate postoperative care of those defects.

Colpectomy, of course, has the lowest incidence of recurrence. However, good results can be obtained with vaginal vault repair. Nichols reports only a 3% recurrence rate in 163 patients having a transvaginal sacrospinous fixation.[6] A recurrence rate of 6% is reported in 144 patients with follow-up undergoing a Symmonds repair.[11] Of those 9 patients who had a recurring prolapse, 6 had a subsequently successful vaginal repair and 1 underwent a successful abdomino-vaginal procedure. It should be noted that in the Nichols and Symmonds series, as many as one third of the patients had previous vault repair procedures. In a small series of patients, Feldman and Birnbaum reported only one failure out of 21 patients undergoing sacropexy.[3]

The author personally has achieved good results in a smaller series of patients with the Symmonds repair. However, when sexual functioning is paramount, sacrospinous fixation is the procedure of choice, and the results in the literature support its selection.

References

1. Beecham CT, Beecham JB: Correction of prolapsed vagina or enterocele with fascia lata. *Obstet Gynecol* 1973; 42:542–546.
2. Berglas B, Rubin IC: Histologic study of the pelvic connective tissue. *Surg Gynecol Obstet* 1953; 97:277–289.
3. Feldman GB, Birnbaum SJ: Sacral colpopexy for vaginal vault prolapse. *Obstet Gynecol* 1979; 53:399–401.
4. Jeffcoate TNA: Posterior colpoperineorrhaphy. *Am J Obstet Gynecol* 1959; 77:490–502.
5. Langmade CF, Oliver JA, White JS: Cooper ligament repair of vaginal vault prolapse twenty-eight years later. *Am J Obstet Gynecol* 1978; 131:134–142.
6. Nichols DH: Sacrospinous fixation for massive eversion of the vagina. *Am J Obstet Gynecol* 1982; 142:901–904.
7. Nichols DH: Vaginal hysterectomy and repair with weak cardinal-uterosacral ligament complex, in Nichols DH (ed): *Clinical Problems, Injuries and Complications of Gynecologic Surgery.* Baltimore, Williams and Wilkins, pp 81–85, 1983.
8. Randall CL, Nichols DH: Surgical treatment of vaginal inversion. *Obstet Gynecol* 1971; 38:327–332.
9. Ridley JH: A composite vaginal vault suspension using fascia lata. *Am J Obstet Gynecol* 1976; 126:590–596.
10. Simmons SC: Dyspareunia following repair—"The skin bridge" and its prevention. *J Obstet Gynaecol Br Comm* 1963; 20:476–478.
11. Symmonds RE, Williams TJ, Lee RL, et al: Posthysterectomy enterocele and vaginal vault prolapse. *Am J Obstet Gynecol* 1981; 140:852–859.

Rectovaginal Fistula and Anal Incontinence

12

Although improvement in the quality of obstetric care, radiation therapy, and surgery has decreased the incidence of rectovaginal fistula and anal incontinence, patients still present to the gynecologist for treatment of these problems.

Anatomy

Repair of both rectovaginal fistulas and surgical anal incontinence often requires division and later reestablishment of the anoperineal muscle complex. (Fig. 12-1) Remember this area is a functional unit. Successful repair reestablishes normal anatomic relationships rather than approximates a single muscle bundle.

The puborectalis muscle in the female is the thick and lower portion of the levator muscle, which forms a sling about the rectum. Contracting, this muscle pulls the rectum vertically and compresses the anal canal from side to side. This striated muscle continues downward joining the external longitudinal muscle layer to form the external sphincter, which closes the anal canal. Although it is often described as having multiple portions, the surgeon will find one elliptical muscle band, indistinguishable from the puborectalis above, attached anteriorly to the central perineal tendon and posteriorly to the anococcygeal ligament.[1] The transverse perineal muscles that insert into the central tendon and proceed laterally to the ischial ramus are important in perineal tone and anal incontinence.[11]

The internal sphincter is the distal thickening of the circular smooth muscle of the bowel, which is approximately 3 cm in length and palpable as the superior margin of the intersphincteric groove. Although involved in defecation, it plays only a small role in anal continence. The internal and external sphincters are separated by the conjoint longitudinal muscle, which becomes increasingly fibrous as it extends distally and ultimately attaches to the perianal skin. The anal canal is closed by the puborectalis pulling upward and the reflex tone of the external sphincter. The latter is assisted by points of fixation to the anococcygeal ligament and the central perineal tendon, which has attachments to the transverse perineal muscles and perineal membrane. The lower space between the rectal and vaginal mucosa contains some fine areolar tissue and blood vessels, the azygous system of the vagina.

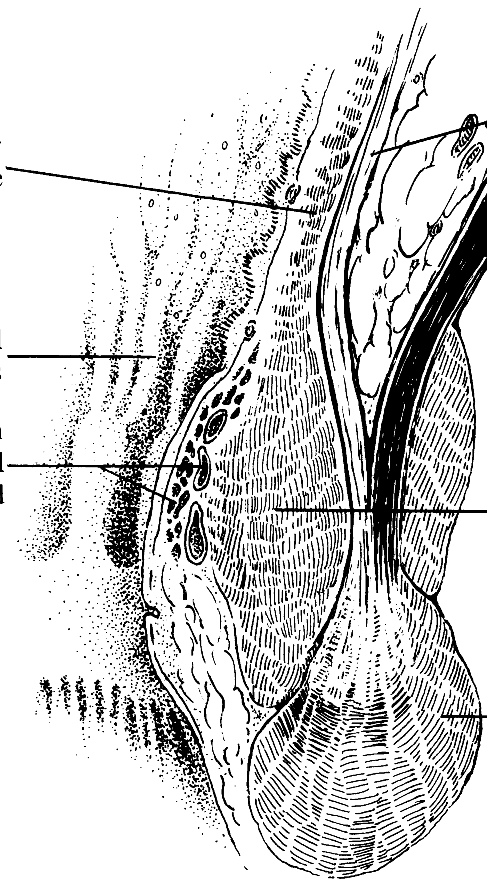


FIGURE 12-1. Shown above is the anatomic detail of the anal orifice. The surgeon may not be able to identify these structures at the operating table, particularly in the damaged or scarred anus. In such instances, anatomic repair of the associated muscular structures is even more essential for a successful operation.

Pathology

Rectal sphincter and anal perineal muscular division may occur with extension of episiotomy, an uncontrolled delivery, or as an unrecognized event in anorectal surgery. When sphincter division occurs as a result of a midline episiotomy, successful repair is expected.[10] If unattended, the perineum may heal with the muscles retracted laterally, with a resultant complete perineal laceration. Patients may maintain continence with hypertrophy of the lower levator muscle in some instances.

Unrecognized surgical division of perineal muscles with retraction may occur as well. This is observed as a small lateral dimple in the perianal skin. When injury extends through the lower vagina into the rectum and the surrounding tissues are normal, spontaneous healing may still occur. If the defect is larger than 1 cm, with associated hematoma, excess suture, or other unrecognized injury, rectovaginal fistula may occur. This is seen most commonly in the obstetric injury due to unobserved entry into the rectum or improper repair at the time of a third-degree injury to the rectum. This group of obstetric fistulas occur in the lower third of the vagina; they comprise the majority of most modern series of rectovaginal fistulas and have an excellent prognosis.

Radiation injury produces particularly difficult fistulas, which occur most commonly in the middle third of the vagina. The basic etiology of radiation-induced fistula is obliteration of the small vessels with resultant ischemic necrosis. Radium or cesium application may produce a localized reaction, whereas whole-pelvis irradiation affects the entire pelvic vasculature; consequently, to promote healing, one must bring blood from some nonirradiated site. Although improved results occur with labial fat pad transplant and omental lengthening, permanent sigmoid colostomy is often the final result of such fistulas.[4]

Fistulas in the upper third of the vagina are usually postsurgical or result from recurrent cancer of the cervix or colon. For example, in pelvic surgery for endometriosis, in which difficult dissection between the rectum and vagina is common, undetected rectal perforation may occur. Abscess will usually result, which then ruptures through the vagina, and a fistula soon becomes apparent by the character of the drainage. If the injury is small, spontaneous closure is anticipated, whereas a larger defect may persist. Recurrent cancer of the cervix or colon may also produce fistulas in the upper third of the vagina. A biopsy of the margins of the fistula should be done to rule out recurrent cancer in those patients with prior pelvic malignancy even though the fistula occurs years later. The author has seen a patient with a small vaginal fistula due to recurrent cancer of the cervix 30 years after treatment.

Preoperative Evaluation

In patients with anal incontinence following obstetric injury, study of the perineal musculature is important. Look for other defects in the puborectalis and transverse perineal muscles and plan their repair, as well as external sphincter approximation. Do a neurologic examination to detect underlying neurologic disease and note the perineal muscle tone of the uninjured portion of the levator. If the rectovaginal fistula is small and difficult to visualize, instill methylene blue in the rectum and observe its appearance in the vagina. If it cannot be detected, pack the vagina with white gauze and recheck after the patient has been ambulatory; blue stain will confirm the presence of this fistula.

If the vaginal mucosa is atrophic, prescribe topical and systemic estrogens for 60 days, which will produce a stronger mucosa more tolerant of suture. If local infection is present, begin a regimen of sitz baths and systemic and local antibiotics.

Order anoscopic and proctoscopic, upper and lower gastrointestinal, and small bowel barium studies to detect associated gastrointestinal fistulas or primary gut disease. The patient may have an ileal fistula, particularly when severe radiation injury has occurred, as well as a slough of the upper rectum or proctosigmoiditis with stricture.

Patients with various types of inflammatory bowel disease, such as Crohn's disease, have a high incidence of rectovaginal fistulas. These fistulas may present initially in the postpartum period. Beynon, reviewing 28,815 midline episiotomies, noted an incidence of 0.06% rectovaginal fistula development.[3] Perineal tissues normally heal satisfactorily after rectal injury; a fistula developing after a fourth-degree episiotomy should raise suspicion of inflammatory bowel disease. Spontaneous healing is rare. Holland and Greiss suggest that medical management should be the mainstay of therapy.[9] With disease in remission (absence of acute inflammatory changes, ulceration, significant stricture on sigmoidoscopic examination), low rectovaginal fistulas may be approached surgically with careful excision of all tracts, followed by layered closure without tension.[2] High rectovaginal fistulas should be managed by fecal diversion, followed by local repair during disease remission.

Although some authors advise delay in the repair of postpartum fistulas for long periods of time, excellent results are obtained with surgery after inflammatory and vascular changes of pregnancy have subsided. Hibbard reports excellent results in a series of patients whose surgeries were performed within 3 months of the development of the postpartum fistula.[8] When irradiation fistula occurs, repair is delayed for at least 6 months. Remember that the changes in radiation arteritis continue for many months and that the full extent of the pelvic injury may not be known at the time of the original rectovaginal fistula. Vesicovaginal fistula, ileovaginal fistula, and ureterovaginal fistula, or external fistula, may be the next clinical event.

In contrast to the other types of rectovaginal fistulas, repair of irradiated rectovaginal fistula requires colostomy. This colostomy is not closed until the fistula appears healed and the barium study is negative when performed 2 months following repair.

Operative Technique

Careful mechanical bowel preparation, as described in Chapter 22, will reduce the infection rate associated with rectovaginal fistula repair. Additionally, povidone-iodine (Betadine) douches the night before surgery will aid in reducing intraoperative contamination.

Basic principles of fistula repair are similar in any site (Figs. 12-2 through 12-6). Excise the fistula so that normal tissues are present. Separate the mucosal layers at least 2 cm from the edge of the fistula and close the mucosa without tension. Bring a layer of well-vascularized tissue between the two layers. When not available locally, one must provide tissues containing a good blood supply, such as the omentum (see Fig. 21-10), labial fat pad, gracilis, or gluteus muscle, for successful repair.[12] Inversion of mucosa or through-and-through closure is equally successful if the layers are well separated.[6,8] When the patient has

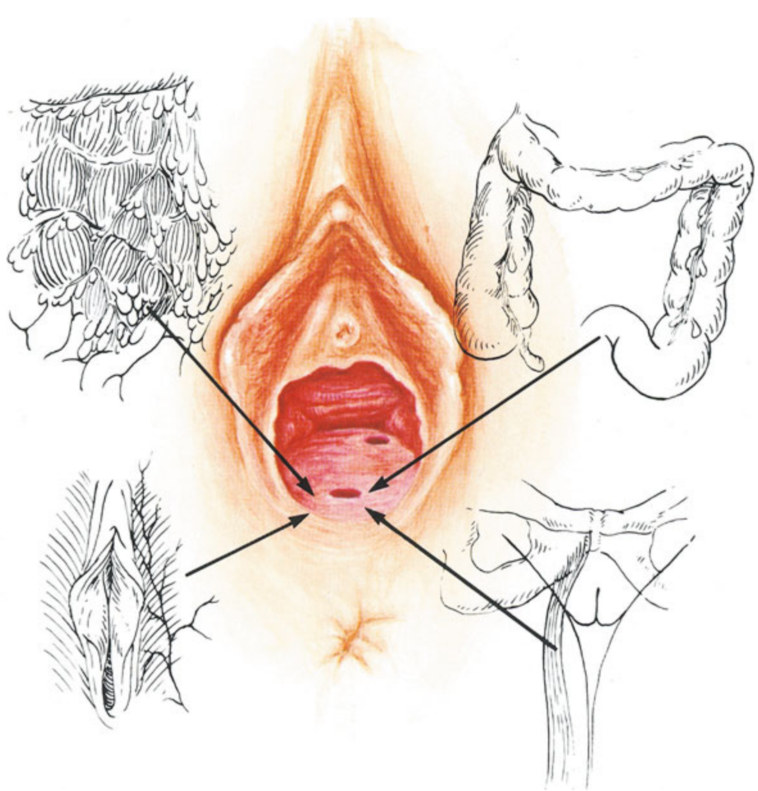


FIGURE 12-2. A rectovaginal fistula may occur in the lower third of the vagina associated with obstetric injury, the middle third of the vagina associated with irradiation therapy or cancer management, and in the upper third of the vagina following abdominal hysterectomy. When the blood supply is poor or irradiation injury contributes to fistula formation, an accessory blood supply must be brought in by means of a labial fat pad transplant, insertion of a tunnel of omentum between the rectum and vagina, or resection and mobilization of the normal sigmoid down to the distal segment, or a gracilias muscle transplant.

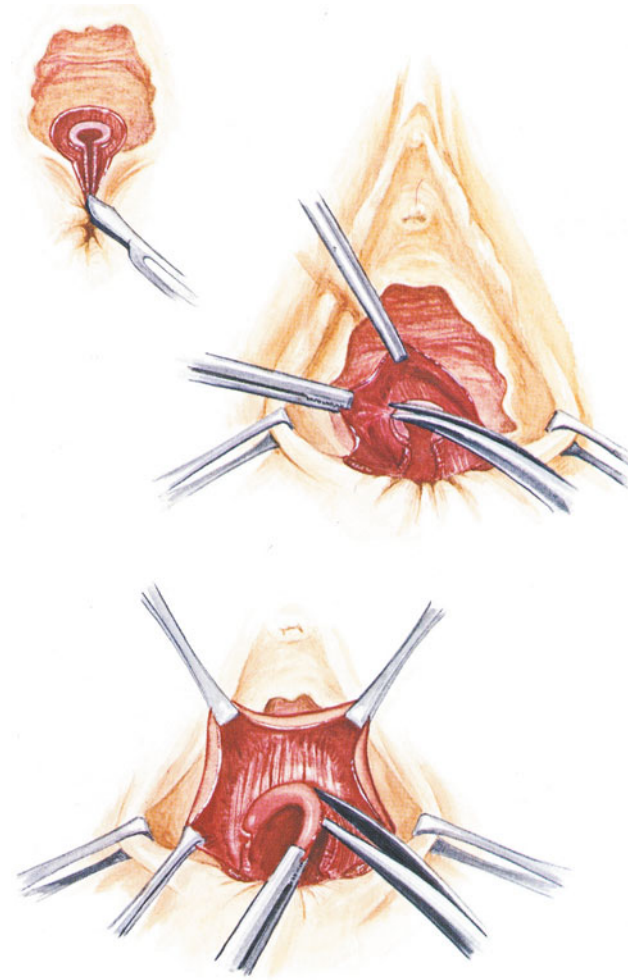


FIGURE 12-3. Surgery of fistula in the lower third of the vagina. Trim the margins of the fistula and incise sharply into the rectum converting the fistula to a third-degree injury. Using sharp dissection, free up the margins 2 cm about the fistula. Excise the fistula so that the margins have good blood supply.

had a failed repair or associated irradiation injury, diverting colostomy is indicated. Finally, repair of the entire muscular unit is recommended for associated anorectal incontinence. Although some use a paradoxical incision in the external sphincter, the author has not found this necessary, and in Hibbard's recent series this procedure was used in only 1 of 27 cases.[8] Although rectal pressure may reach 85 cm H_2O,[7] this does not pose a threat to the usual fistula repair as such pressure is reduced by maintaining the patient on an elemental diet following surgery, thereby eliminating the need for a paradoxical incision.

Postoperative Management and Results

The postoperative hospital stay for simple sphincter repair and small obstetric fistula repair is usually three to four days. Remove the patient's catheter as soon as she is awake and alert and begin sitz baths. Place the patient on a liquid diet for three days and prescribe stool softeners. The patient may continue using estrogen and local antibiotic creams in the vagina if postmenopausal. Remove the monofilament nylon sutures in the vaginal epithelium seven to ten days postoperatively. Continue the stool softeners and sitz baths for 3 weeks.

The patient is instructed not to have an enema for 2 weeks and to resume intercourse in 6 weeks. If the patient has a colostomy, she is instructed in

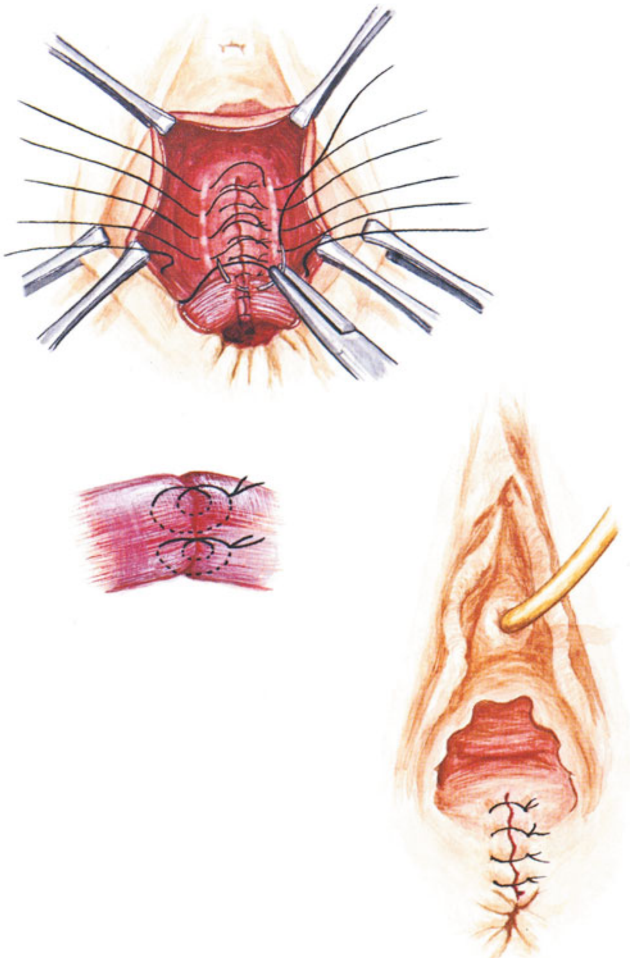


FIGURE 12-4. Close the rectal mucosa in a vertical fashion, employing wedge-type sutures, which pull more submucosa together than rectal mucosa. Place a second layer of fine 4–0 absorbable sutures above this and imbricate the second layer over the suture line. There should be no compromise in the mucosal blood supply and all mucosa must be covered. Use 2–0 absorbable in the lower margins of this incision to secure the lateral distal portion of the levator ani muscle as it courses downward to insert in the central perineal tendon. Bring the lower part of this suture through the anterior portion of the capsule of the rectal sphincter. Isolate the rectal sphincter and close it with far-and-near sutures of 2–0 absorbable. Close the vaginal wound with interrupted sutures of 3–0 nylon.

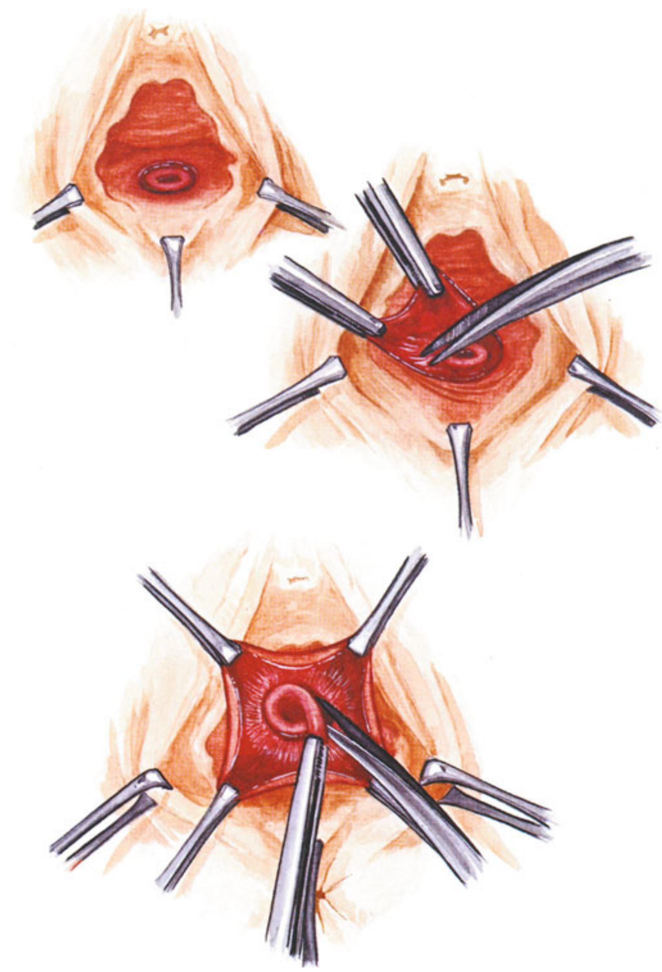


FIGURE 12-5. Surgery of fistula in the middle third of the vagina. Isolate the fistula from the surrounding structures, insert a Foley catheter to improve visibility, pull directly upward, and incise sharply around the margins of the fistula. Using fine thumb forceps and sharp scissors, dissect 2 cm away from the fistula margin. Excise the margins of the fistula back to normal appearing tissue.

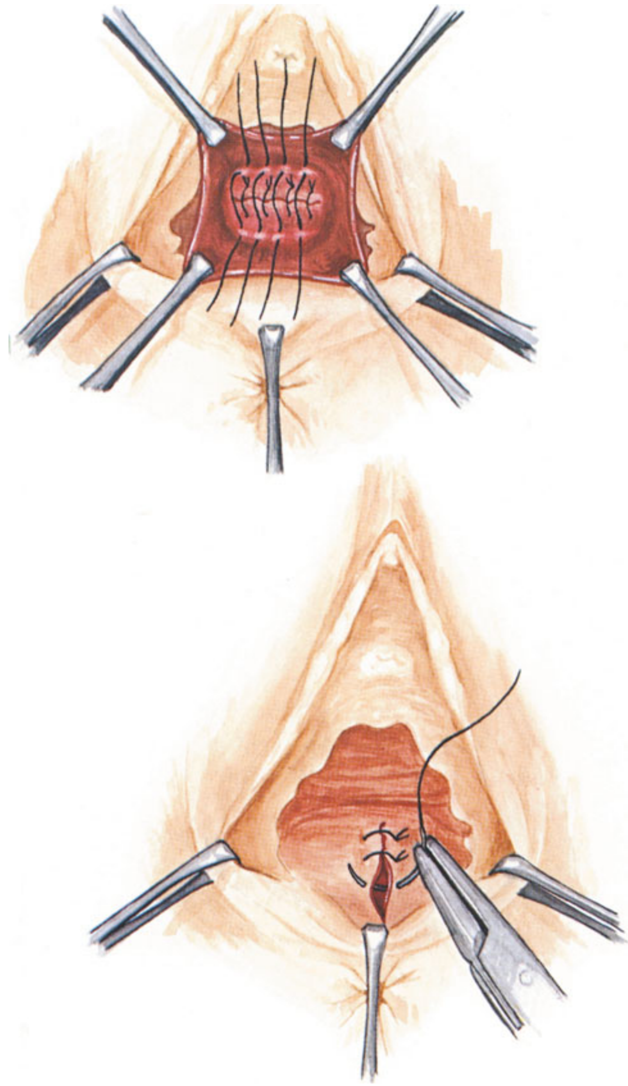


FIGURE 12-6. Close the rectal mucosa, employing a wedge-type suture containing larger amounts of submucosa than epithelium. Imbricate the perirectal tissues and muscle over this in a transverse fashion. Close the defect produced with interrupted sutures of 3–0 monofilament nylon or absorbable.

routine colostomy care. In cases of abdominal closure for high fistula, post-laparotomy care is sufficient.

When anorectal incontinence is due to the failure to approximate the muscles following surgery or vaginal delivery, 92% of patients improve following repair.[11] The initial repair of a low rectovaginal fistula due to obstetric trauma is successful in 95% of patients.[8] The results in midlevel rectovaginal fistula due to irradiation vary greatly with the severity of other associated injuries to the bladder or small bowel and associated rectal stricture. If rectovaginal fistula alone exists, the use of accessory blood supply and diverting colostomy is usually successful. Bricker recommends a two-stage, transabdominal, onlay patch anastomosis in repairing irradiation-induced rectovaginal fistulas.[5] The technique uses the proximal nonirradiated colon as an antiperistaltic vascular pedicle graft to patch the defect without resecting the rectum or colon. Of the 22 patients who have undergone this procedure, 19 have had satisfactory to excellent results; one has had poor results; and two surgeries were total failures. One patient, whose surgery was a failure, died of complications secondary to irradiation.

If severe injury extends throughout the anorectum with proctitis and stricture, colostomy is recommended. Associated urinary or small bowel fistula indicates widespread damage and makes colostomy advisable.

References

1. Anson B (ed): *Morris' Human Anatomy,* 12th ed, New York, McGraw-Hill, 1966.
2. Bandy LC, Addison A, Parker RT: Surgical management of rectovaginal fistulas in Crohn's disease. *Am J Obstet Gynecol* 1983; 147:359–363.
3. Beynon CL: Midline episiotomy as a routine procedure. *Am J Obstet Gynaecol Br Comm* 1974; 81:126–130.
4. Boronow RC: Management of radiation-induced vaginal fistulas. *Am J Obstet Gynecol* 1971; 110:1–7.
5. Bricker EM, Johnston, WD, Kraybill WG, et al: Reconstructive surgery for the complications of pelvic irradiation. *Am J Clin Oncol* 1984; 7:81–89.
6. Given FT: Rectovaginal fistula. *Am J Obstet Gynecol* 1970; 108:41–45.
7. Greenwald JC, Hoexter B: Repair of rectovaginal fistulas. *Surg Gynecol Obstet* 1978; 146:443–445.
8. Hibbard LT: Surgical management of rectovaginal fistulas and complete perineal tears. *Am J Obstet Gynecol* 1978; 130:139–141.
9. Holland RM, Greiss FC Jr: Perineal Crohn's disease. *Obstet Gynecol* 1983; 62:527–529.
10. Kaltreider FD, Dixon DM: A study of 710 complete lacerations following central episiotomy. *South Med J* 1948; 41:814–819.
11. Moore FA: Anal incontinence: A reappraisal. *Obstet Gynecol* 1973; 41:483–493.
12. Stirnemann H: Treatment of recurrent rectovaginal fistula. *Am J Proctol* 1969; 20:52–54.

Vesicovaginal Fistula

13

Kermit E. Krantz

The obstetric vesicovaginal fistula was described in the Hindu medical literature as early as 800 BC. The mummy of Egyptian Queen Henheit dating from 2050 BC had a vesicovaginal fistula of probable obstetric origin.[6] A high percentage of fistulas due to obstetric causes still occur in Third World nations. Naidu recently reported 208 cases from Hyderabad, India[10]; Hamlin and Nicholson collected more than 2,000 cases in Ethiopia by 1972[9]; and Tahzib studied the epidemiologic factors of 1,443 cases in an 11-year period in a northern Nigerian hospital.[12] In the United States, however, as in most developed countries, a majority of fistulas are due to gynecologic surgery. Abdominal hysterectomy alone accounts for 76.6% of cases seen; vaginal hysterectomy and anterior repair account for another 17.2%.[5]

Most fistulas resulting from abdominal hysterectomy are caused by the failure to adequately dissect the bladder well down off the cervix and anterior vagina. A portion of the bladder is then included in either the clamp used or the sutures placed, with resultant necrosis and fistula. Urine usually appears in the vagina 1 to 2 weeks after surgery in these patients. If the bladder has been incised and not closed, urine appears promptly through the vaginal cuff. Fistulas appearing later are usually associated with a hematoma and infection.

Preoperative Evaluation

Initial studies should include an evaluation of the upper urinary tracts. Lagundoye et al studied 216 cases of vesicovaginal fistulas and noted that 105 patients had calyceal blunting, 75 had hydroureter, and 10 had kidneys that did not function at all.[6] Although some of these were chronic fistulas, this study serves to emphasize the importance of an investigation of the upper urinary tract in studying vesicovaginal fistula. An injury that involves the bladder may well obstruct the ureter, or the patient may have multiple injuries.

To evaluate the patient, a Foley catheter is placed into the bladder and a solution of methylene blue is injected. If the patient has a vesicovaginal fistula, the dye will of course appear promptly in the vagina. If the fistula is a large one, little difficulty will be encountered in isolating it. Very small fistulas, particularly those in a recent postoperative site, may be hard to detect and may require the placing of a vaginal tampon in the vagina. The patient is then place in bed with the Foley catheter clamped. If the tampon is stained blue on removal, a vesicovaginal fistula is documented. If the tampon is urine-soaked but colorless, the patient most likely has a ureterovaginal fistula.

Wesolowski and Meaney recommend insertion of a vaginal tampon prior to the administration of a contrast medium for excretory urography in patients in whom a small fistula is suspected but has not been documented.[13] The tampon is left in place until the bladder is distended; it is then removed and placed alongside an unused tampon and a film is taken. Opacification of the tampon confirms the presence of these small fistulas.

Most gynecologic fistulas are in the midline and are well away from the ureters; however, if there is any question, a cystoscopic examination and injection of indigo carmine for identification are recommended. The author routinely has a cystoscope available in the operating room so that the fistula may be observed prior to and following its repair.

Ureteral catheters usually are unnecessary. If the ureteral orifices are near the edges of the fistula, however, a catheter is placed prior to the repair to avoid incorporating the ureter in the fistula repair. If the ureter is in the edge of the fistula, it is best cut and reimplanted into the bladder (Chapter 26).

While there is great debate in the literature about the appropriate time to repair a vesicovaginal fistula, the crucial factor is the amount of inflammation and necrosis present. As with any reconstructive procedure, the tissues to be operated on should be as clean and as free from intense inflammatory response as possible. This may be clinically apparent in some patients quite soon after the fistula develops; in others weeks may be required. If the fistula is observed in the immediate postoperative period, the patient can be taken promptly to the operating room and the fistula can be repaired before any significant collagen formation has a chance to occur. The fistula is easily exposed and repaired, and the edema, which is one of the initial responses of inflammation, increases the ease of dissection. The formation of collagen does not begin until after the fifth day of wound healing, so that repair prior to this time is uncomplicated by scar formation.

During the preoperative evaluation the patient is given local antibiotics and, if postmenopausal, estrogens. The estrogens will increase the blood supply to the vagina, making it much easier to work with the vaginal epithelium. If the inflammatory changes are acute, the patient is placed on systemic antibiotics. If there are significant changes in the surrounding skin due to urine irritation, zinc oxide applied locally on a tampon will aid healing and decrease maceration.

Operative Technique

Postoperative Fistula

The great majority of postoperative fistulas can be repaired through the vagina (Figs. 13-1 through 13-5). The author of this technique has not had a failure in an uncomplicated postoperative fistula in 18 years.

Transitional epithelium is remarkable in its ability to seal when approximated and to be watertight within 24 hours. Peacock and Van Winkle demonstrated the prompt healing of bladder muscle in less than 14 days with a significant and appreciable percentage of original tissue strength regained by that time.[11] For this reason, and because stones may form if a permanent suture is placed in the transitional epithelium, repair of bladder muscle is accomplished with absorbable suture (such as 3–0 or 4–0 chromic gut or Vicryl placed in bladder muscle).

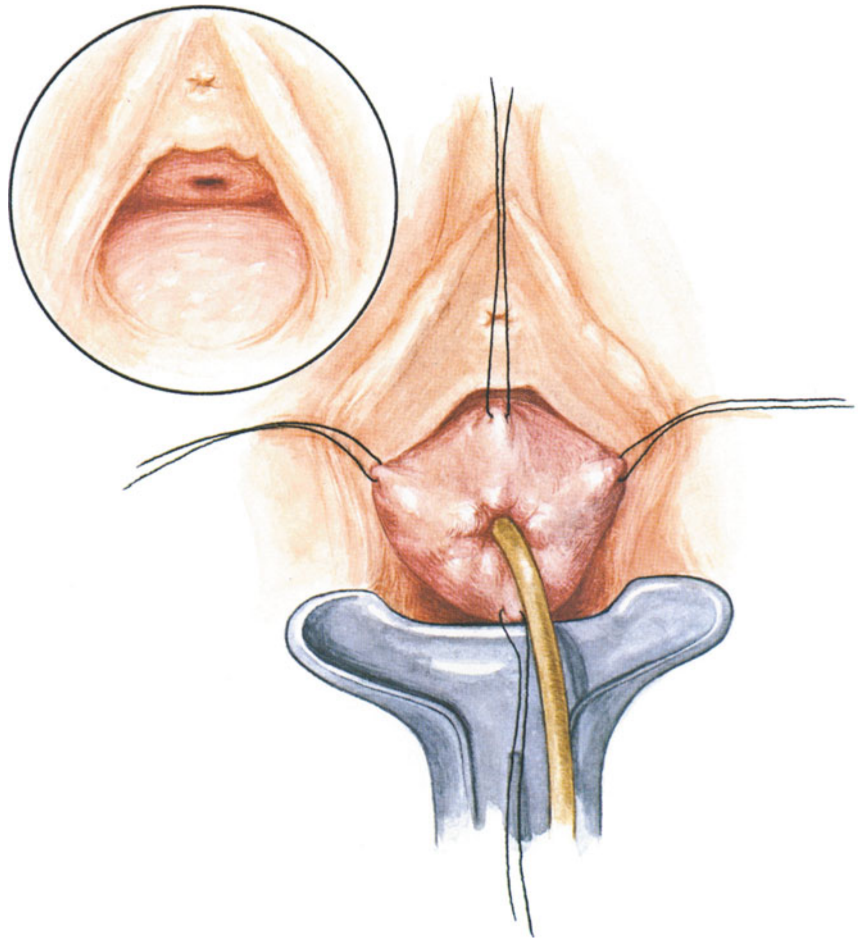


FIGURE 13-1. Place the patient in the lithotomy position and expose the fistula. If the patient has a very stenotic introitus and the fistula cannot be visualized, make a midline episiotomy, or if the perineum is moderately scarred and stenotic, make a Schuchardt-type incision up to the apex of the vagina exposing the fistula.

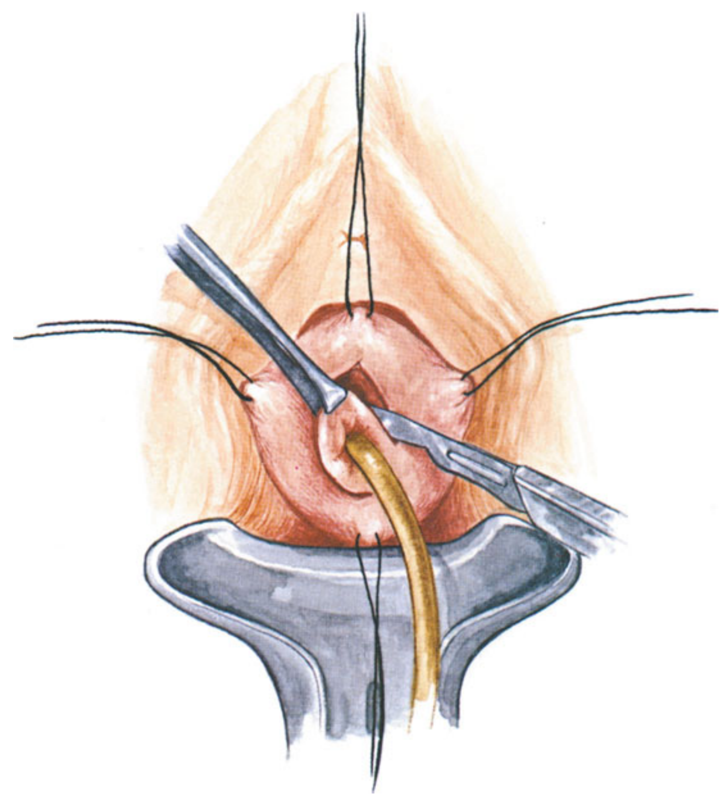


FIGURE 13-2. Place a small Foley catheter in the fistula and inflate the bulb, pulling the fistula downward. Place four traction sutures at each margin of the exposed vagina, pulling laterally. Using a small sharp blade, make an incision about the fistulous tract through all layers and into the bladder.

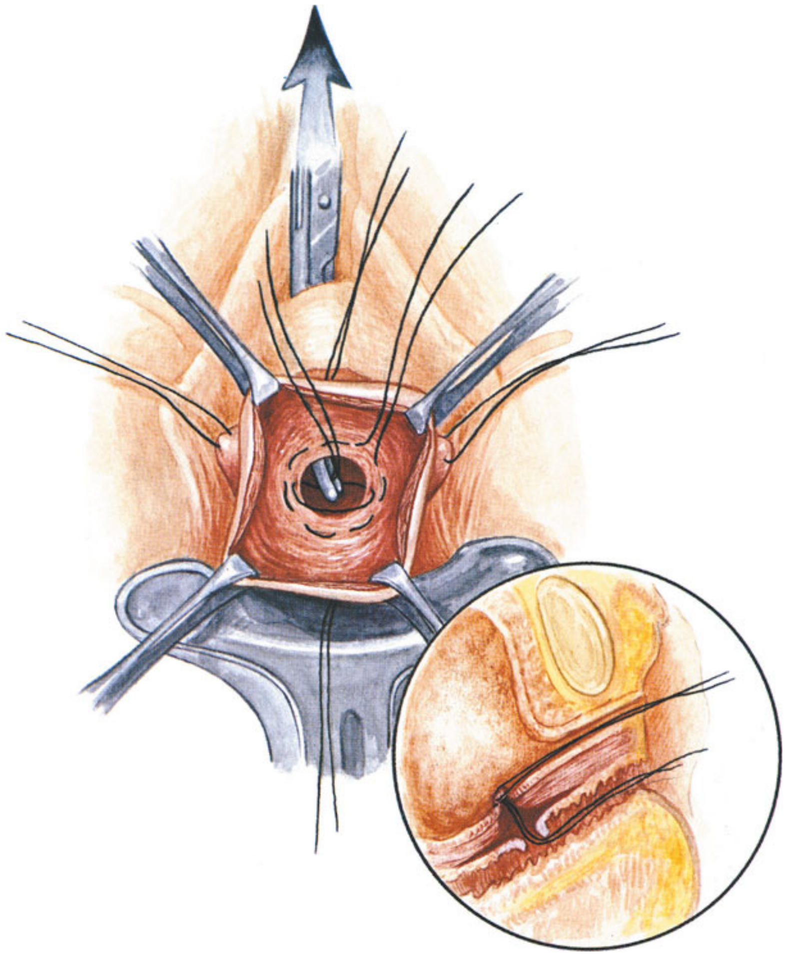


FIGURE 13-3. Dissect the bladder muscularis free of the vagina for a distance of 2 cm on each side and trim any remaining fibrous tissue in the bladder wall and excise any remaining fistulous tract. Place a 2–0 chromic suture through the margins of the fistula. Pass a long hemostat through the urethra and grasp the suture, tenting the fistulous tract into the bladder. Place the 4–0 purse-string suture around the tract, avoiding the suture perforating the transitional epithelium of the bladder. Tie the purse-string.

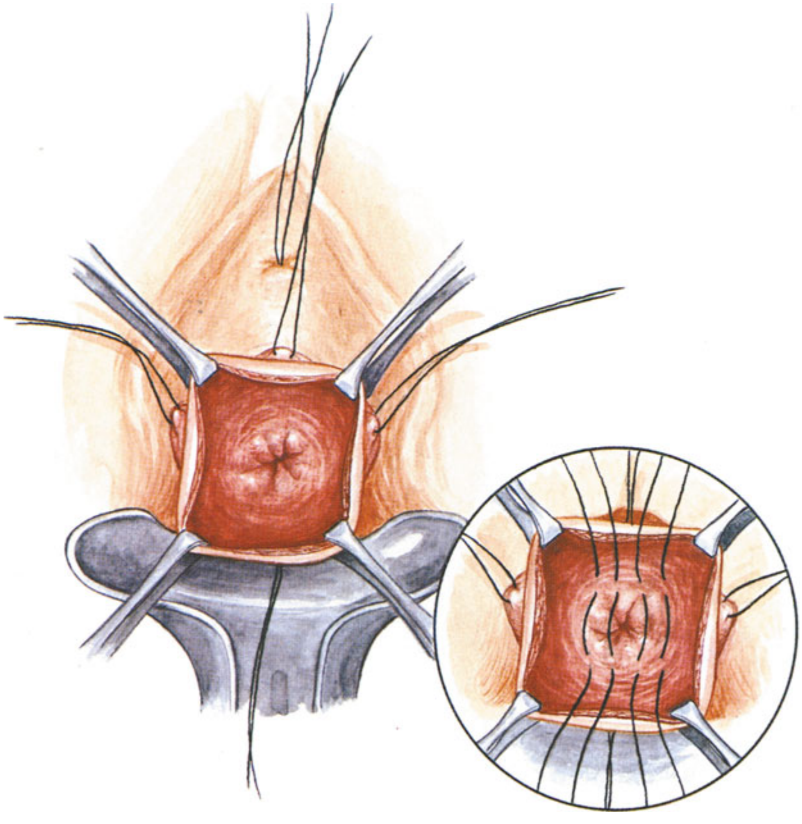


FIGURE 13-4. After the purse-string suture has been tied, place vertical imbricating sutures of 3–0 or 4–0 chromic through the bladder muscularis, imbricating adequate margins of bladder muscle. Have no epithelium visible in the muscularis closure and use great care not to enter the bladder mucosa with the stitches. While placing and tying the muscularis suture, tension on the traction suture through the urethra minimizes the chance of epithelial involvement.

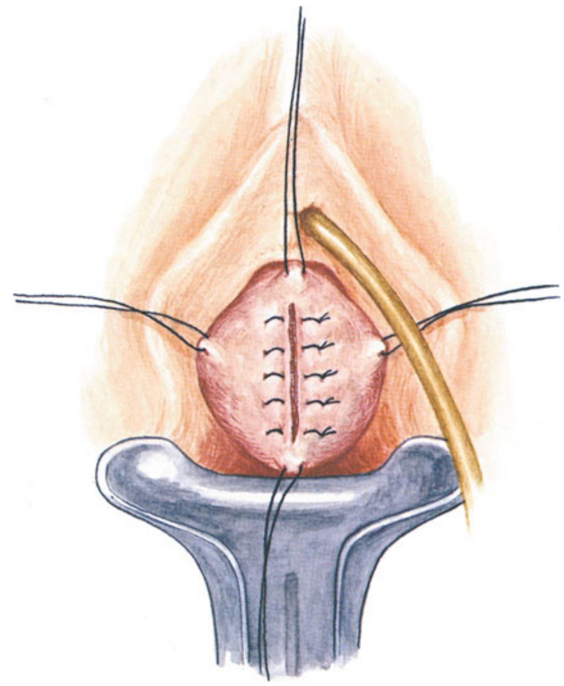


FIGURE 13-5. Pull one end of the 2–0 margin suture so that it is removed from the bladder through the urethra. Close the vaginal epithelium with vertical mattress sutures of 2–0 chromic gut. Remove the traction sutures.

Following closure, triple sulfa cream containing estrogen is placed in the vagina along with a vaginal pack. A Foley (No. 24) catheter is placed in the urethra. The catheter is removed as soon as there are not more than four red cells per high-power field in the urine. Most patients have clear urine in 3 to 5 days. Patients are allowed to ambulate immediately and are discharged as soon as the Foley catheter is removed. The patient is managed essentially as a patient who has undergone a vaginal hysterectomy except that she is cautioned not to resume intercourse for 6 weeks. There is no increased incidence of stress incontinence nor should significant sexual dysfunction result after this type of repair.

One might question whether a bladder that has not been distended for a period of years could resume normal function. Moir notes that bladder capacity returned to normal after repairs of fistulas that had existed for as long as 32 years.[8]

Obstetric Fistula

Whereas the gynecologic fistula is brought on by crushing injury, misplaced suture, or undiagnosed laceration, the obstetric fistula is usually due to ischemic necrosis caused by obstructed labor. Tissue loss may be much greater in these patients. Naidu reported 201 cases of fistula due to obstetric trauma.[10] Most of these were managed by separating the bladder from the vagina and inverting the bladder mucosa. Sixty-nine of the large fistulas were repaired by mobilization of the bladder downward with fixation to the lower remainder of the bladder as described by Thomas. Hassim and Lucas noted an increasing incidence of postoperative stress incontinence if the fistula involves the bladder neck; consequently, they found better postoperative results when closing the fistula in the long axis of the vagina and reinforcing the bladder neck.[3] Where the repair was under tension, labial fat pad grafts were used to assist closure. Where there was extensive destruction of the bladder and urethra, the Hamlon-Nicholson gracilis muscle transplant produced the best final result. Of their

150 patients with obstetric fistula, 11 (7%) showed residual stress incontinence. Of these 11 patients, 8 were treated with the Marshall-Marchetti-Krantz procedure and 4 improved. Three patients were treated with ureterosigmoidostomy.

In patients with recurrent fistula, the reason the original repair failed must be considered. If the vagina is so badly scarred and strictured that exposure is difficult, transvesical repair may be considered. The Schuchardt incision may also be used for exposure. Recurrent fistula with any question of sufficient blood supply should have a labial fat pad transplant for additional blood supply.

Irradiation-Induced Vesicovaginal Fistula

Surgery of vesicovaginal fistula associated with irradiation therapy requires great experience and proper timing for success. Fistulas occurring after radiation therapy are due to obliterative endarteritis. The basic abnormality in irradiation is endothelial injury in the small vessels with a ischemic necrosis. Additional blood supply must be brought from an unirradiated area to restore the blood supply necessary to heal the suture line. The inability of the irradiated tissue to produce fibroblasts as rapidly as unirradiated tissue must be taken into account in the postoperative period.[2]

The incidence of fistulas usually increases as the total dose of irradiation increases. If the blood supply to the bladder is compromised, additional injury is probably present in the rest of the pelvic viscera as well. The vesicovaginal fistula may be the first of a line of fistulas including ureterovaginal, rectovaginal, and ileovaginal fistulas. The presence of a cystocele increases the irradiation-induced complication rate in the urinary tract as well.[7] The patient must understand this prior to surgical repair or she may feel the subsequent fistulas are a complication of the original procedure. Additionally, the fistula may be due to recurrent pelvic cancer which requires a biopsy at the fistula margin and a workup for metastatic disease.

The attendant fibrosis in radiation therapy makes mobilization of tissues difficult and associated vaginal stenosis and mucosal atrophy may render the fistula difficult to expose. If the fistula is associated with cervical cancer treatment, estrogens may be used without risk. If prior malignancy was endometrial cancer, of course, estrogens are not used unless the date of original tumor treatment makes recurrence unlikely. Careful study of the patient's intravenous pyelogram must be made as the ureters may be injured as well and obstructive uropathy may promote deterioration of renal function.[1] Where the fistula can be exposed vaginally, the gracilis muscle or labial fat pad are additional sources of blood supply in the lower portion of the bladder. Where the fistula is at that apex of the vagina, the omental pedicle may be used to separate the bladder mucosa from the vagina. Inversion of the mucosa, separate muscular layer suture lines in both bladder and vagina, and placement of accessory blood supply between bladder and vagina are essential for a satisfactory result. Unfortunately, the underlying vascular damage and tissue loss may be so great as to preclude successful repair.

Approximately 50% of patients with irradiation-induced vesicovaginal fistula will best be initially managed by or ultimately require an ileal or colon conduit for urinary control.

Recently, Hoskins et al reported two cases using a bulbocavernosus myocutaneous "island" flap to repair fistulas.[4] They achieved good results in repairing a vesicovaginal fistula secondary to irradiation which could not be repaired primarily. This technique may offer patients who have extensive tissue damage or loss an opportunity for a successful repair.

References

1. Boronow RC, Rutledge F: Vesicovaginal fistula, radiation, and gynecologic cancer. *Am J Obstet Gynecol* 1971; 111:85–90.
2. Grillo HC, Potsaid MA: Studies in wound healing: IV. Retardation of contraction by local x-irradiation and observations relating to the origin of fibroblasts in repair. *Ann Surg* 1961; 154:741–750.
3. Hassim AM, Lucas C: Reduction in the incidence of stress incontinence complicating fistula repair. *Br J Surg* 1974; 61:461–465.
4. Hoskins WJ, Park RC, Long R, et al: Repair of urinary tract fistulas with bulbocavernosus myocutaneous flaps. *Obstet Gynecol* 1984; 63:588–593.
5. Keettel WC, Laube DW: Vaginal repair of vesicovaginal and urethrovaginal fistulas, in Buchsbaum HJ, Schmidt JD (eds), *Gynecologic and Obstetric Urology.* Philadelphia, Saunders, 1982, ch 21.
6. Lagundoye SB, Bell D, Gill G, et al: Urinary tract changes in obstetric vesicovaginal fistulae: A report of 216 cases studied by intravenous urography. *Clin Radiol* 1976; 27:531–539.
7. Masterson BJ, Rutledge F: Irradiation ulcer of the urinary bladder. *Obstet Gynecol* 1967; 30:23–27.
8. Moir JC: Personal experiences in the treatment of vesicovaginal fistulas. *Am J Obstet Gynecol* 1956; 71:476–491.
9. Moir JC: Vesicovaginal fistulae as seen in Britain. *J Obstet Gynaecol Br Comm* 1973; 80:598–602.
10. Naidu PM: Vesicovaginal fistulae: An experience with 208 cases. *J Obstet Gynaecol Br Comm* 1962; 69:311–316.
11. Peacock EE Jr, Van Winkle W Jr: Healing and repair of viscera, in *Wound Repair.* Philadelphia, Saunders, 1976, ch 12.
12. Tahzib F: Epidemiological determinants of vesicovaginal fistulas. *Br J Obstet Gynaecol* 1983; 90:387–391.
13. Wesolowski DP, Meaney TF: Use of a vaginal tampon in the diagnosis of vesicovaginal fistulae. *Radiology* 1977; 122:262.

14 Surgery of the Vulva

Ernest W. Franklin, III

Modern surgical therapy for vulvar disease consists of diagnostic studies, excisional procedures, and reconstructive operations. The cornerstone of diagnosis is the vulvar biopsy, which is described in detail in Chapter 1. Except for those lesions of an infectious etiology such as *Trichomonas vaginalis* or *Candida albicans*, most other chronic vulvar conditions will require biopsy for definite diagnosis. Use of the nomenclature of the International Society for the Study of Vulvar Disease is recommended.[19] Note that this is a histologic classification, hence, accurate diagnosis is only possible after appropriate biopsy material has been obtained (Table 14-1).

Anatomy

The blood supply of the vulva consists of labial branches of the pudendal artery coursing from the lateral margin of the vulva medially, as well as a small transverse perineal artery. A small branch of the femoral artery, the external pudendal, enters the vulva anteriorly and laterally. The veins drain laterally and up into the iliac system. The sensory nerves supplying the vulva enter laterally with the vessels and branch out into the labial cutaneous nerves.

The lymphatics of the vulva have recently been studied by Jones.[13] He observed that the lymphatics have a discrete margin at the labial crural fold and drain upward to the medial group of the superficial groin nodes. Although there are lymphatic pathways demonstrable to the urethra and clitoris, direct metastasis to the deep pelvic nodes, omitting the groin nodes, is a rare clinical occurrence.[6] The superficial groin nodes drain upward, join the lymph channels from the leg, and collect around the great vessels in the thigh and in the lymph nodes situated there. They course medially to enter the node of Cloquet, which is the highest groin node, usually located in the femoral canal medial to the femoral vein. The lymph drainage is upward, continuous with the external iliac system and, hence, to the periaortic nodes.

Preoperative Evaluation

As noted, a representative biopsy is the basis for the planning of both medical and surgical therapy of vulvar disease. Where moderate or severe vulvar cellular atypia is found, colposcopic examination of the cervix and endocervical curettage are in order. Both intraepithelial and invasive carcinoma of the vulva are frequently associated with prior, concurrent, or subsequent neoplasia of the vagina and cervix. In the author's experience, associated malignancies of the lower reproductive tract may be seen in as many as 40% of patients with vulvar neoplasia. Staining of the vulva with 1% toluidine blue to detect nuclear activity and application of 3% acetic acid to accent hyperkeratosis are useful to find multicentric foci. Vulvar colposcopy is of limited benefit for biopsy site selection as the overlying keratin obscures the vascular patterns.

Complete physical examination, admission blood screens, and chest x-ray study, complete the preoperative evaluation of these patients. Cystoscopy, proctoscopy, intravenous pyelograms, and barium enema should be used if there is clinical evidence of involvement of these organ systems.

TABLE 14-1. New Nomenclature for Vulvar Disease (International Society for the Study of Vulvar Disease)

I. Vulvar dystrophies
  A. Hyperplastic dystrophy
    1. Without atypia
    2. With atypia
  B. Lichen sclerosus
  C. Mixed dystrophy (lichen sclerosis with foci of epithelial hyperplasia)
    1. Without atypia
    2. With atypia
II. Vulvar atypia
  A. Without dystrophy
  B. With dystrophy
III. Paget's disease of the vulva
IV. Squamous cell carcinoma in situ

Operative Strategy

The vulvar dystrophies without atypia require no surgical therapy. Topical progesterone, testosterone and/or corticosteroid creams are useful in controlling distressing pruritus, which often accompanies these disorders.[12] Condyloma may be treated with podophyllin, laser, or trichloroacetic acid. Where increasing cellular atypia is noted on biopsy, local excision and close observation are in order because of the multifocal nature in as many as 35% of these lesions.[11] Local excision is adequate also for small areas of carcinoma in situ when multifocal, superficial vulvectomy is indicated. Evaluation of margins by frozen section is essential to avoid incomplete resection and recurrence, which may otherwise occur in 40% of patients. Remember that it is the entire anogenital tract, including the cervix, vagina, vulva, perineum, anus, and intergluteal crease, which is at risk when vulvar precancerous lesions occur.

Vulvectomy does not remove all of the epithelium at risk and may be an excessive procedure for a lesion of low malignant potential. Forney et al reported that of 25 patients with carcinoma in situ of the vulva managed conservatively, none progressed to invasive cancer.[4] Japaze et al noted no deaths due to invasive cancer in a 5-year follow-up of conservative management of 71 cases of carcinoma in situ of the vulva.[11] It is imperative when superficial vulvectomy is employed that invasive cancer be ruled out by a biopsy study of any thickened or ulcerated areas. Owing to the looseness of the vulvar skin, the margins can usually be mobilized and approximated to cover the defect in this superficial excision (Fig. 14-1).

If a split-thickness graft is required, preservation of the labial fat pads will produce a more normal-appearing external genitalia. Split-thickness skin grafting may be extended to the anal verge without colostomy if preoperative bowel preparation and postoperative liquid diet of 1 week are ordered.

Fibrosis due to chronic trauma or postoperative scarring may produce an introital stricture (Figs. 14-2 and 14-3). The use of preoperative estrogens and a carefully performed vaginal wall advancement or Z-plasty will increase introital size and relieve sexual discomfort.

Chronic vulvar pruritus may be associated with psychosexual difficulties and the patient must be carefully evaluated prior to any surgical procedure for the purpose of improving sexual function.

Basal cell carcinoma occurs in 1.4% of vulvar neoplasms; granular cell myoblastoma appears much less frequently.[20] Although prone to local recurrence if inadequately excised, these lesions rarely metastasize to lymph nodes. Adequate wide local excision will usually suffice; the frequent use of frozen sections and the changing of instruments should a suspicious tissue be encountered will reduce the local recurrence rate to a minimum.

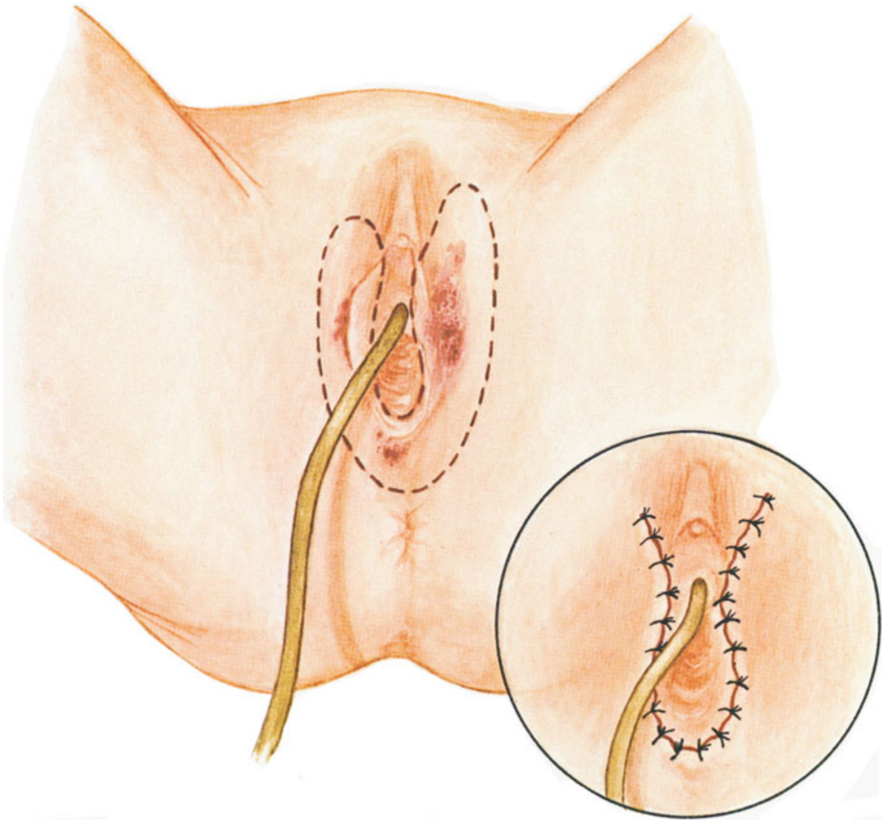


FIGURE 14-1. When carcinoma in situ or severe dysplasia is multifocal, perform a simple vulvectomy. Be certain that no invasion exists by means of a prior biopsy. Preserve the clitoris if uninvolved. Incise the area using hooks to elevate the skin; undermine and free up the full thickness of the vagina and vulvar skin. Secure bleeders with 4–0 absorbable suture and skin edges with 3–0 monofilament nylon. If too much tension exists, use full-thickness flaps for coverage. Although a split-thickness graft covers the defect nicely, it produces a poorer functional result.

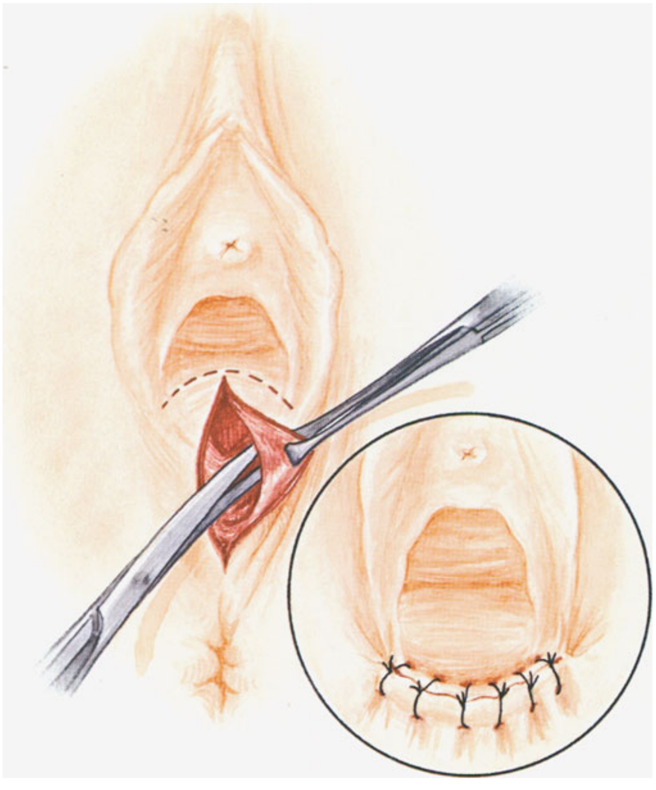


FIGURE 14-2. Use a posterior vaginal wall advancement when an introital stricture is present and adequate posterior vagina is available. Free up the posterior vagina widely after incising in the midline. Advance the posterior vagina and close in a transverse fashion with monofilament nylon.

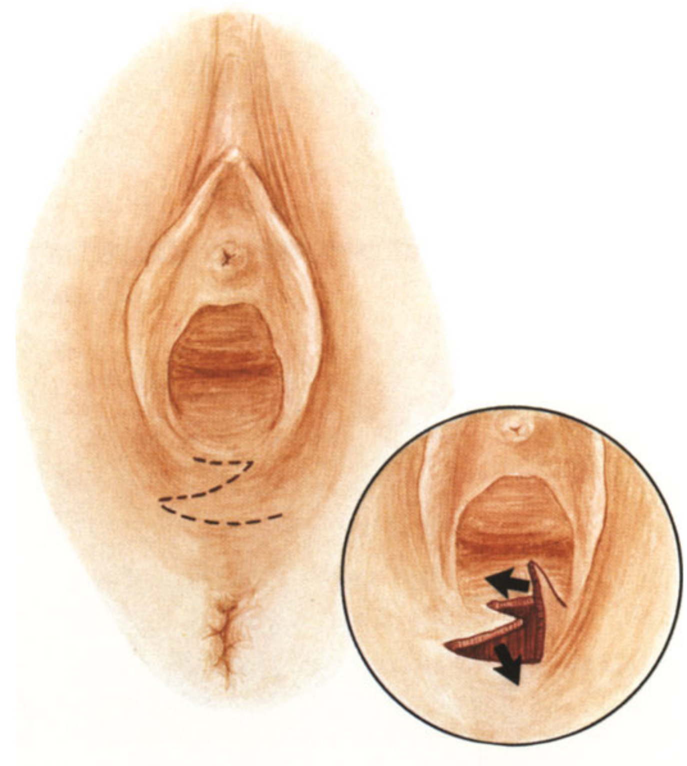


FIGURE 14-3. Use a Z-plasty for introital stricture when a transverse scar is present. Outline the flaps with a marking pen. Cut sharply to underlying fascia and transpose with skin hooks. Suture with monofilament 3–0 sutures.

A few primary soft-tissue sarcomas of the vulva have been reported with varying results. Wide local excision is needed for these lesions.[3] Unlike epidermoid carcinomas, distant metastases, presumably hematogenous, may occur without regional node involvement.

Paget's disease is a rare skin lesion that occurs in the vulva and is associated with skin adnexal tumors or other malignancies in approximately 20% of cases. A complete preoperative evaluation as outlined is necessary in these lesions, which appear grossly as exematoid weeping skin disease. Paget's cells often extend beyond the gross margins of the lesion. Toluidine blue is of no value in demonstrating the margins of these lesions; frozen sections are required to assure complete excision of this lesion. If an adnexal cancer is associated with the cutaneous lesion, radical vulvectomy and inguino-femoral node dissection is required. Although excision of deep nodes has been recommended, there appear to be no survivors with positive deep pelvic nodes.[1] As this disease often occurs in elderly patients, excision of deep nodes may be omitted without significantly affecting long-term survival. Excision of vulvar skin is often extensive, and additional coverage may be required. Single or bilateral rotational thigh flaps are very useful in covering these defects (Fig. 14-4).[14]

Malignant melanoma is the second most common lesion of the vulva and accounts for 4.8% of vulvar neoplasms.[20] Vulvar pigmented nevi are often precursors of melanomas and should be routinely excised. Therapy for malignant melanoma varies with the level of the penetration of the skin according to definitions of Clark's levels.[18] Histologic interpretation of pigmented vulvar lesions, particularly those that are chronically inflamed or infected, is fraught with hazard, and expert opinion should be obtained. Where definite invasive malignant melanoma (level 3 or greater) exists, exploratory laparotomy with evaluation of the liver and periaortic nodes is in order. When the liver is negative for metastatic disease, retroperitoneal and pelvic node dissection followed by groin dissection and vulvectomy is recommended.

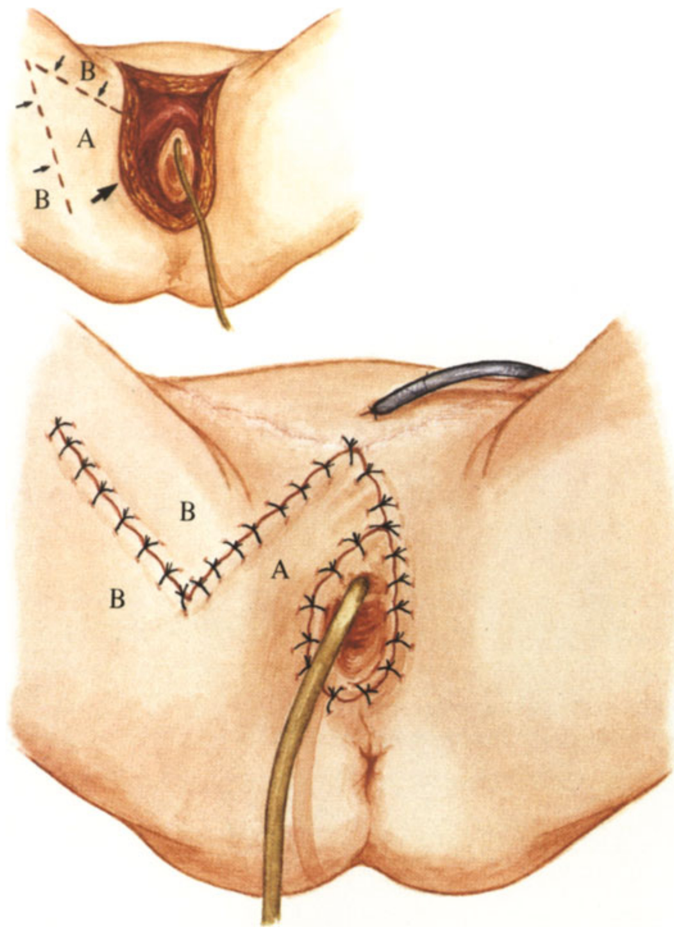


FIGURE 14-4. Woodruff's group has described the management of extensive vulvar defects by means of local flap grafts. The author has utilized this procedure with good results and recommends its use. When vulvectomy procedures produce too large an excision of vulvar skin for primary closure, as in the excision of local recurrence as illustrated, Paget's disease, or carcinoma in situ, skin flaps are useful. Outline the flap with a marking pen and carefully measure the area of placement. Make certain the base is as wide as the flap is long. Use a template cut from a disposable drape. Cut the flap directly downward to the fascia and free the flap along the fascial plane. Handle the flap gently with hooks. Secure hemostasis with fine mosquito clamps and 4–0 absorbable suture. Transpose the graft and attach it as it lies loosely in the defect. Absolutely no tension is permitted. Mobilize the margin of the flap site, taking care not to injure the blood supply at the base. Insert a small suction catheter through the mons and carry it downward beneath the flap. Attach the flap with 3–0 monofilament nylon. Mobilize the margin of the flap site and close with 3–0 nylon. No dressings are required and the sutures are removed in 2 weeks.

Invasive Carcinoma of the Vulva

Approximately 86% of vulvar malignancies occur as squamous cell cancer in elderly patients presenting with vulvar itching and a lesion of long duration.[20] These cancers are predominantly low grade and metastasize late in their clinical course through predictable pathways via the inguinal lymph nodes. The classification of vulvar cancers developed by the International Federation of Gynecologists and Obstetricians is presented in Table 14-2.

Whereas Wharton et al reported a series of patients with no positive groin nodes when invasion was less than 5 mm,[23] Magrina et al recently reported

TABLE 14-2. Clinical Staging of Carcinoma of the Vulva (International Federation of Gynecologists and Obstetricians, April 12, 1970)

T: Primary tumor
- T1. Tumor confined to the vulva—2 cm or less in largest diameter
- T2. Tumor confined to the vulva—more than 2 cm in diameter
- T3. Tumor of any size with adjacent spread to the urethra and/or vagina and/or perineum and/or anus
- T4. Tumor of any size infiltrating the bladder mucosa and/or the rectal mucosa, including the upper part of the urethral mucosa and/or fixed to the bone

N: Regional lymph nodes
- N0. No nodes palpable
- N1. Nodes palpable in either groin, not enlarged, mobile (not clinically suspicious of neoplasm)
- N2. Nodes palpable in either or both groins, enlarged, firm, and mobile (clinically suspicious of neoplasm)
- N3. Fixed, confluent, or ulcerated nodes

M: Distant metastases
- M0. No clinical metastases
- M1A. Palpable deep pelvic lymph nodes
- M1B. Other distant metastases

Stage	Classification	Characteristics
I	T1 N0 M0 T1 N1 M0	All lesions confined to the vulva with a maximum diameter of 2 cm or less and no suspicious groin nodes
II	T2 N0 M0 T2 N1 M0	All lesions confined to the vulva with a diameter greater than 2 cm and no suspicious groin nodes
III	T3 N0 M0 T3 N1 M0 T3 N2 M0	Lesions extending beyond the vulva but without grossly positive groin nodes
	T1 N2 M0 T1 N2 M0	Lesions of any size confined to the vulva and having suspicious groin nodes
IV	T1 N3 M0 T2 N3 M0 T3 N3 M0 T4 N3 M0	Lesions with grossly positive groin nodes regardless of extent of primary
	T4 N0 M0 T4 N1 M0 T4 N2 M0	Lesions involving mucosa of rectum, bladder, or urethra, or involving bone
	M1A M1B	All cases with distant or palpable deep pelvic metastases

96 patients with microinvasive cancer with 5 mm or less invasion and a 10% incidence of positive groin nodes.[15] If the lesion is anaplastic or invades lymph nodes or vessels, groin dissection is still recommended in microinvasive cancer of more than 2-mm invasion at the present time. Otherwise, lesions of up to 3-mm invasion below the base of the adjacent noninvasive epithelium may be managed by local excision alone[9] or with superficial inguinal lymphadenectomy.[2]

Planning therapy for invasive squamous cell carcinoma of the vulva involves excision of the primary lesion, management of groin nodes, and therapy for pelvic lymph nodes (Figs. 14-5 through 14-18).

Excision of the Primary Vulvar Lesion

In all invasive vulvar cancers, perform a radical vulvectomy extending from the skin of the labial crural folds inward and include sufficient skin and soft

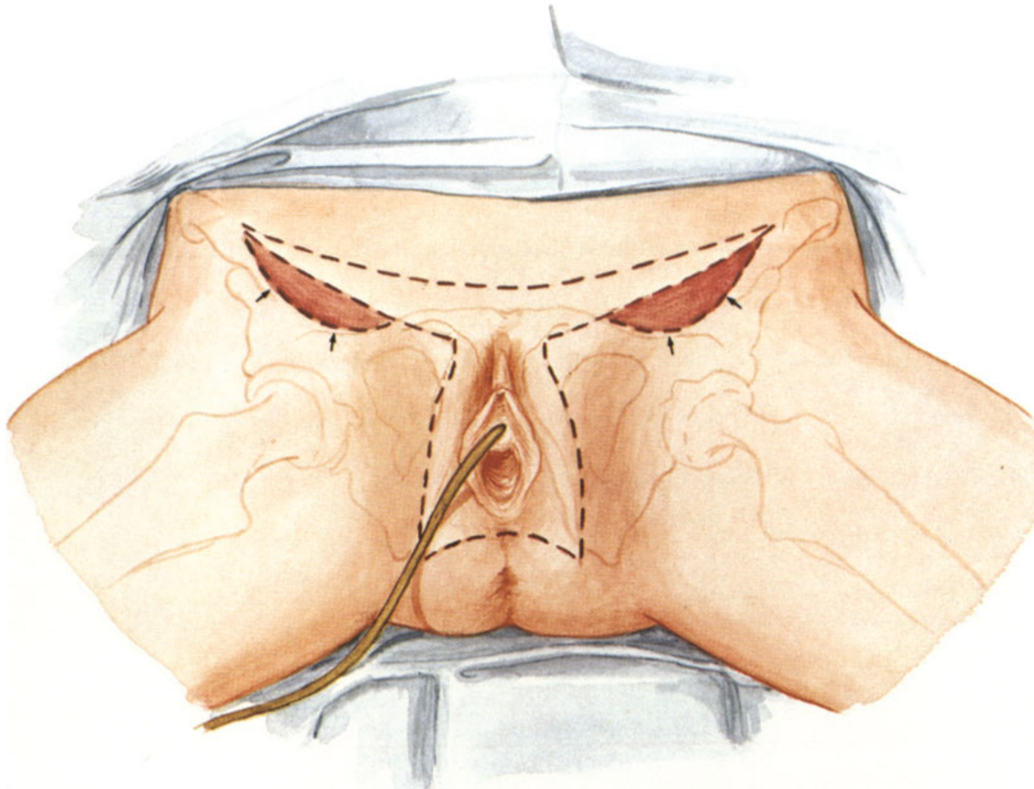


FIGURE 14-5. Planning of excision of the primary lesion and regional nodes begins with evaluation of the clinical extent of the disease to assure its complete excision as well as closure of the primary incision. The incision for inguinal lymphadenectomy begins 2 cm inferior and medial to the anterior superior iliac spine.

tissues to allow free margin about the tumor. Although most vulvar cancers arise laterally on the labium majora, some advanced lesions involve the bladder or rectum. Vulvectomy with proctectomy or exenteration may be needed. Although in the older literature Boronow noted only 16% survivors with stage III or IV vulvar cancers, more recent reports suggest improved survival.[22] Increasing the amount of irradiation therapy and reducing the amount of tissue surgically excised has produced better 5-year survival rates as well.[20] Although the advisability of lymph node dissections is a controversial issue, all authors agree that complete excision of the primary vulvar lesion is mandatory if therapy is to be successful. It makes little sense to spend two to four hours on bilateral groin and pelvic lymph node dissections for sites where disease might possibly be, and then expend only a few minutes on the most important phase of treatment where disease is most assuredly present. The local control of the primary cancer is essential for successful vulvar cancer treatment.

Inguinal Lymphadenectomy

On the basis of a large collected series of cases, 13% of clinically palpable, but not suspicious, lymph nodes (N0N1) contain occult cancer.[6] Large firm mobile nodes (N2) contain metastatic cancer 70% of the time, and 90% of fixed confluent or ulcerated nodes (N3) contain metastatic cancer. Fundamental treatment of invasive cancer of the vulva therefore includes resection of

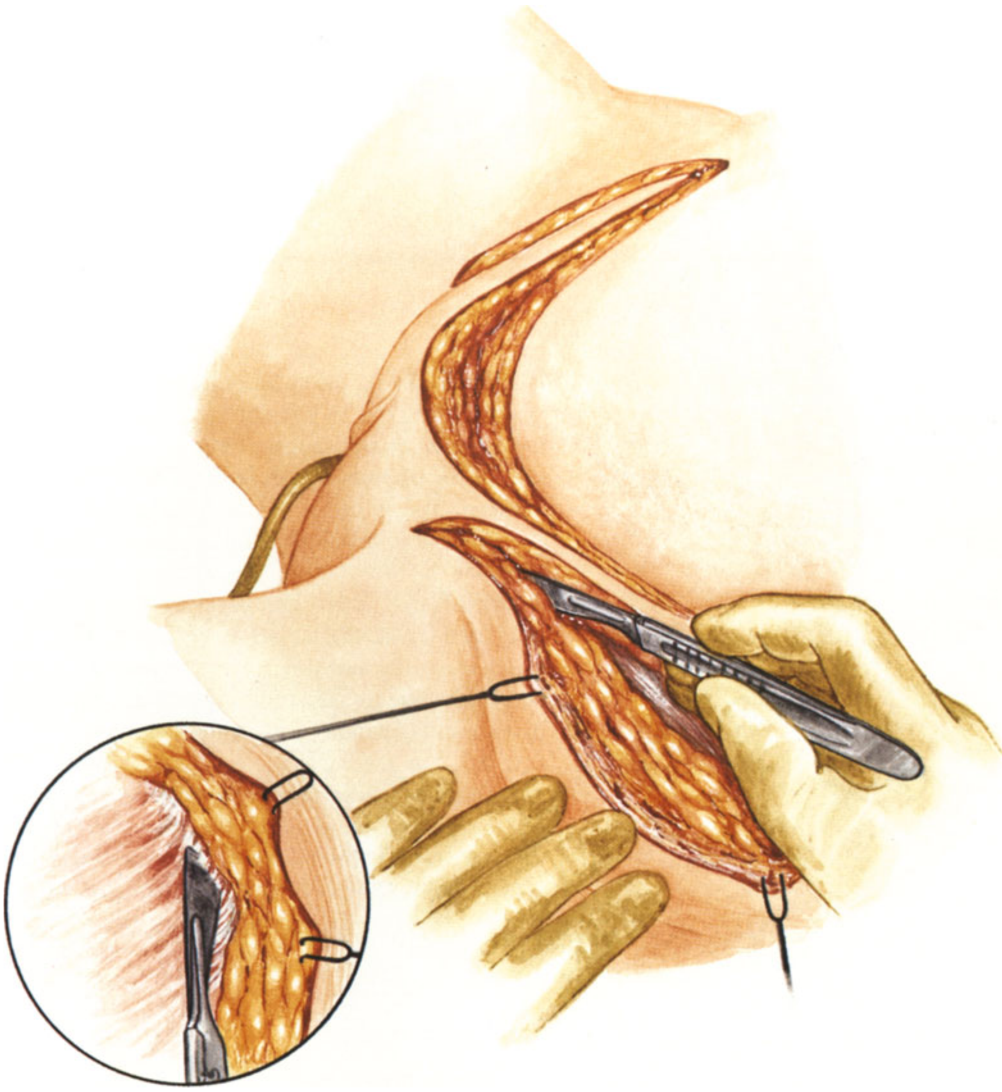


FIGURE 14-6. Place the patient in the supine position with the legs slightly flexed and the hips rotated outward. Drape the patient with multiple sterile half-sheets, allowing for repositioning of the patient for the vulvectomy. Prepare the perineal field last, and place sterile sheets under the patient. Begin the skin incision 2 cm inferior and medial to the anterior superior iliac spine and curve it down to a point 2 to 3 cm above the symphysis. Make the lower incision outlined in Fig. 14-5 parallel to and curving downward slightly toward the vulva. When N2 or N3 nodes are present, excise the overlying skin in continuity and cover it with a flap or graft. For lesions of the posterior vulva, bring the crescentic incision quite low over the mons to a point just superior to the base of the clitoris but retreat to the superior margin of the mons pubis for clitoral and anterior vulvar lesions. Similarly, the posterior limit of excision may advance to the lowest margin of the vagina with sparing of the perineal body and skin for an anterior vulvar lesion, while a posterior lesion may require excision of the perineal body or, on occasion, proctectomy. *Inset:* The plane of dissection is in the fine areolar tissue just anterior to the aponeurosis of the external oblique muscle and is entered with strong upward traction on the overlying tissues with skin hooks. Avoid unnecessary trauma to the flap edges and moisten them with saline intermittently. Ligate any bleeding perforators in the anterior abdominal wall and clamp the round ligament where it exits the ring of the abdominal wall.

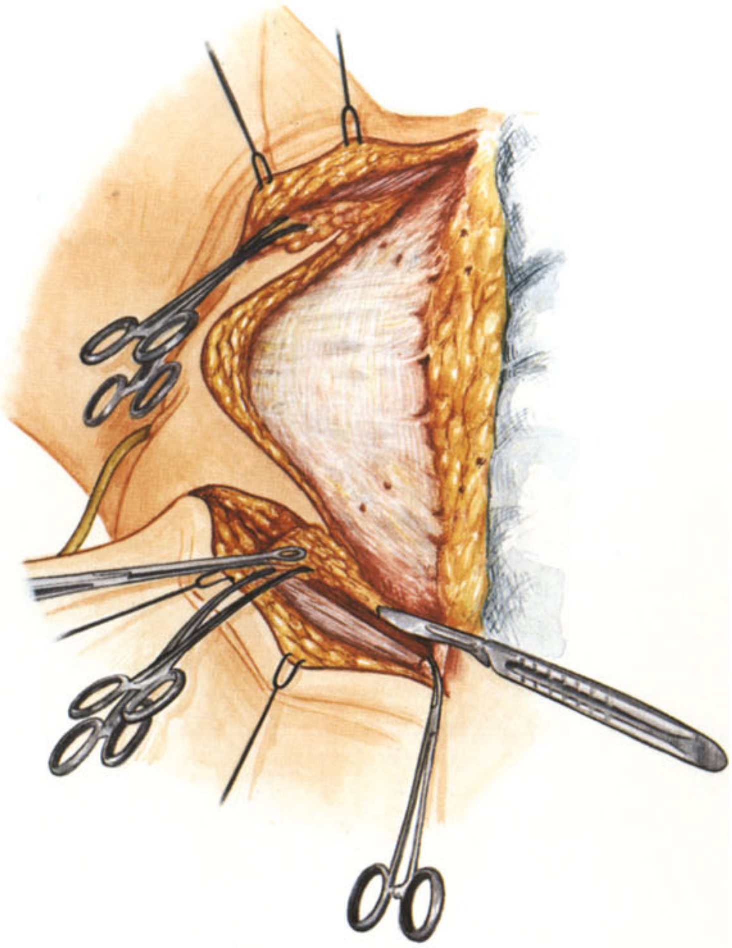


FIGURE 14-7. Extend the transverse crescentic incision to the rectus sheath and external oblique fascia, mobilized by the sharp dissection, avoiding trauma to skin edges. Palpate the course of the sartorius muscle laterally within the groin incision. Incise down to the medial margin of the sartorius muscle through its fascia to allow entrance to the plane of dissection deep to the femoral fasica across the femoral vessels. Carefully dissect at the upper lateral aspect of the incision medial and inferior to the anterior superior iliac spine to define the superficial circumflex iliac vessels, which are clamped, divided, and sutured. The medial pedicle of these vessels provides a point of traction as the sharp scalpel dissection proceeds medial to the sartorius muscle and across the femoral nerve. The origin of the circumflex iliac vessels must be identified on the lateral aspect of the femoral artery when this is reached.

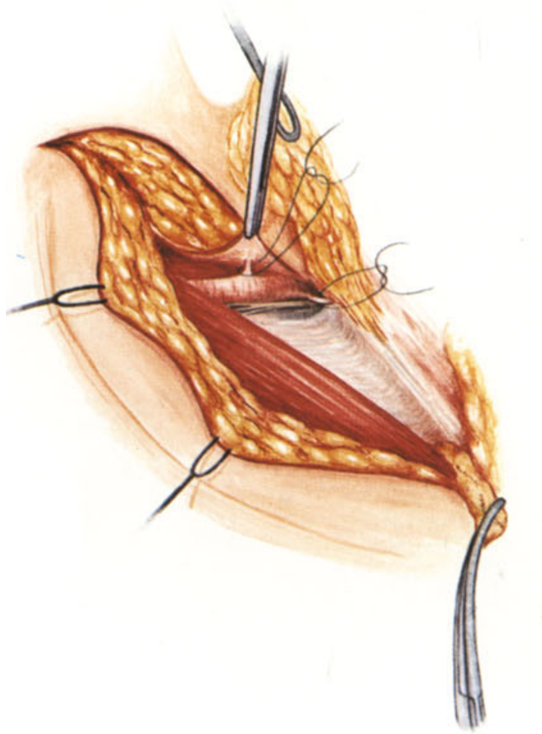


FIGURE 14-8. Palpate and identify the femoral artery. Dissect with the scalpel medially across the femoral artery as the deep femoral fascia is reflected medially. The superficial external pudendal artery is secured and its location is noted as the origin of the saphenous vein passing through the fossa ovalis is immediately adjacent. Isolate, secure, and divide both vessels.

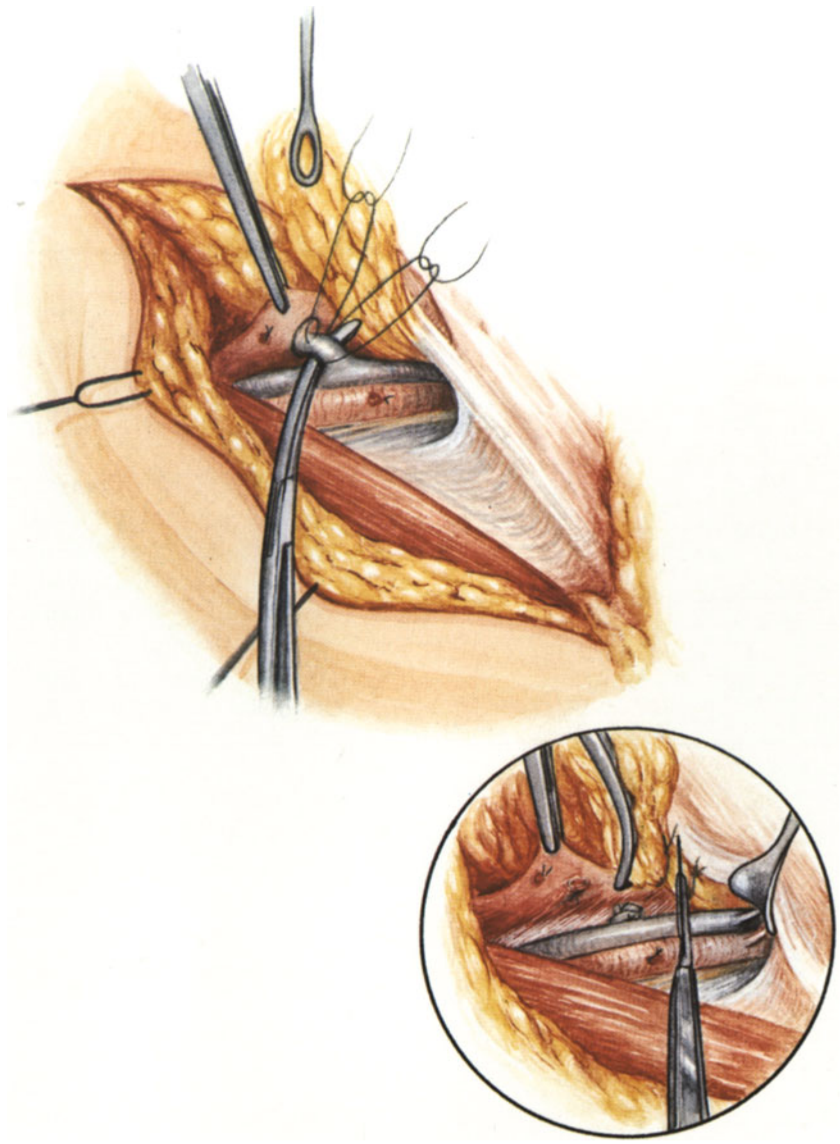


FIGURE 14-9. Suture the saphenous vein pedicle in such a fashion as to leave it flush with the wall of the vein to avoid the formation of a thrombus or turbulance, which would predispose to embolism. Incise the inferior margin of the specimen to expose the saphenous and possibly the accessory saphenous vein. Palpate the surrounding tissues to identify the induration of the accompanying lymphatics. Clamp, divide, and ligate both vein and lymphatics with 2–0 braided nylon in order to prevent persistent lymphatic drainage into the groin dissection, resulting in a lymphocutaneous fistula or lymphocele. Medial traction on the specimen allows sharp dissection across the pectinius fascia and medial branches from the femoral artery and vein to the pectineus muscle may be identified and preserved. After clamping and division of the round ligament, the specimen is advanced by sharp dissection across the fascia covering the pubis, and the specimen hangs dependent over the vulva. Carefully explore the femoral canal, placing the inguinal ligament on anterior traction to expose the inferior epigastric vessels arising from the most inferior limit of the external iliac vessels. *Inset:* The femoral lymphatics enter the femoral canal medial to the vein. Careful palpation will identify the lymphatic fat pad containing Cloquet's node. Extract the lymphatics, which are clipped at their upper limit and divided. Cloquet's node and any palpable and suspicious lymph nodes within the groin dissection are submitted for frozen section. In the absence of metastasis to either site, pelvic lymphadenectomy may be omitted.

FIGURE 14-10. Continue the medial dissection in the pectineus fascia, then proceed to the medial inferior margin of the adductor longus, where the saphenous vein exits the femoral triangle. Ligate and transfix this vessel with 2–0 braided nylon and reflect the specimen medially.

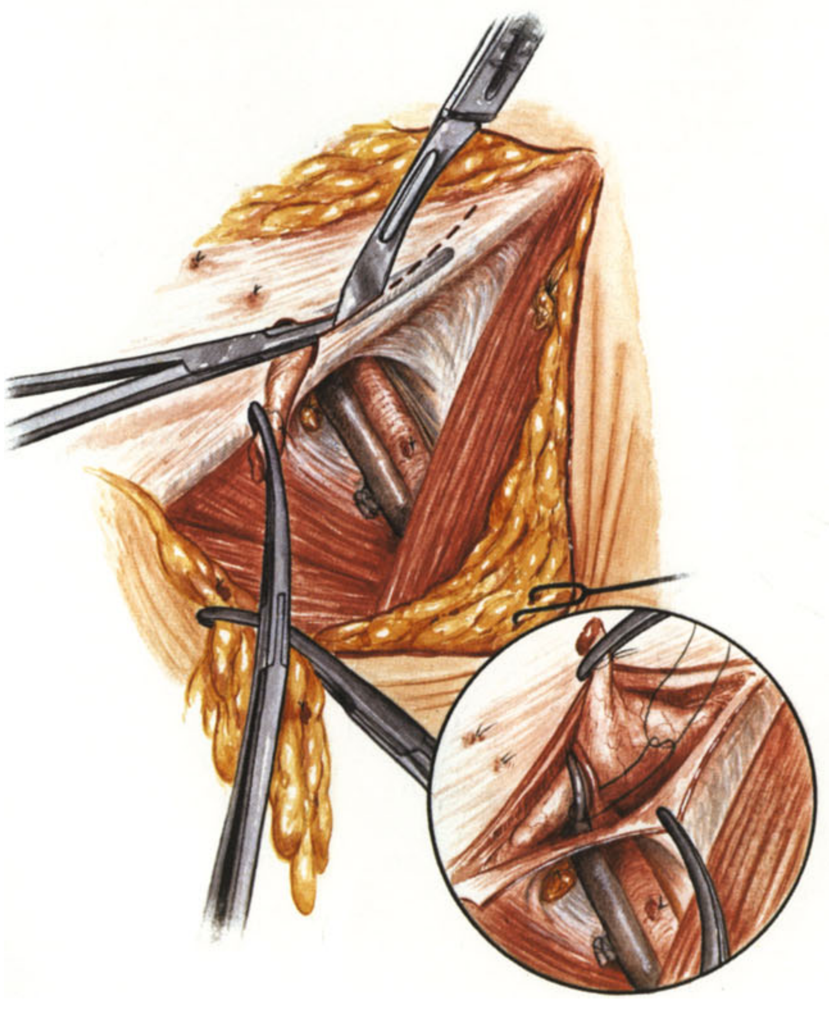


FIGURE 14-11. Extraperitoneal node dissection is indicated when metastasis to the groin or Cloquet's node is present. Initiate this dissection by placing the round ligament in traction. Insert a Coller clamp into the inguinal canal and incise the overlying muscle and fascia. Place the inferior fascial margin and round ligament in traction while identifying the origin of the inferior epigastric vessels from the external iliac artery and vein. *Inset:* Ligate and divide these vessels with 3–0 braided nylon. Traction on the round ligament results in medial traction on the peritoneum, exposing the extraperitoneal space.

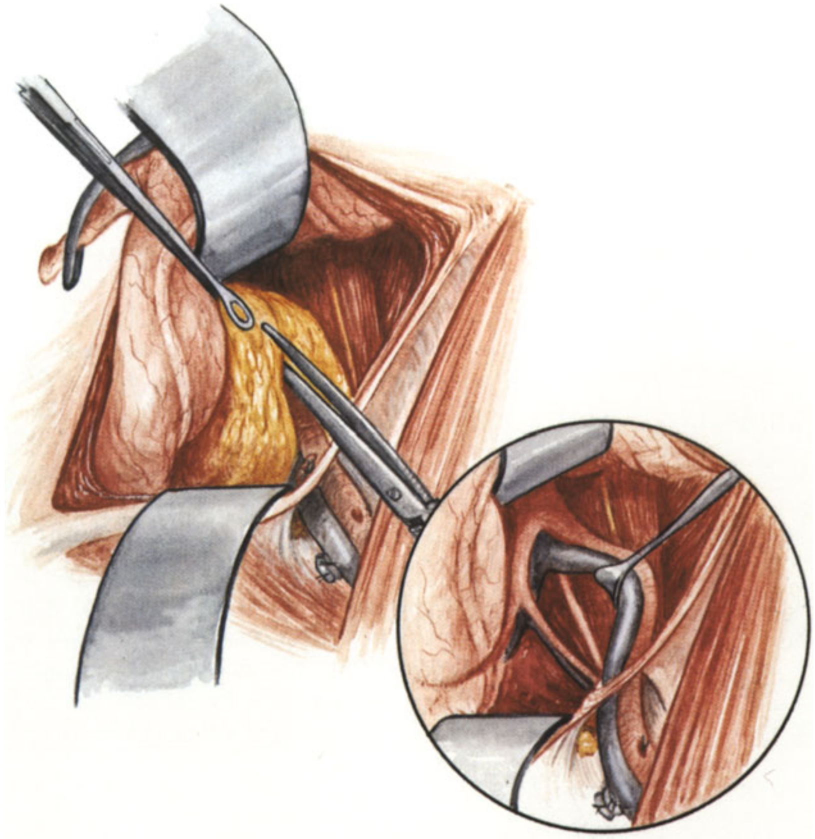


FIGURE 14-12. Blunt dissection separates the peritoneum medially. This measure, plus traction of the bladder, allows exposure of the course of the external iliac vessels and of the obturator fossae to the level of the common iliac artery and vein. Place a fiberoptic light source into the wound. Begin the lymph node dissection laterally on the illiacus fascia medial to the genitofemoral nerve. Reflect the lymph node specimen medially across the vessels with care to preserve the origin of the deep circumflex iliac artery and vein just superior to the inguinal ligament and note the possibility of an aberrant obturator vein on the medial aspect of the external iliac vein just superior to the inguinal ligament. *Inset:* Lift the external iliac upward with a vein retractor. Identify the site of transection of the lymphatics passing through the femoral canal and reflect this medially and superiorly as the specimen is removed from the obturator fossae. Identify the obturator nerve and the artery and vein lying deep to the nerve. Identify the ureter on the peritoneal reflection retracted medially as the lymphatic specimen is dissected from the obturator fossae and up the course of the iliac vessels to the bifurcation. Be alert for an anomalous iliac vein. Further traction superiorly will allow for extensive palpation and dissection lateral to the common iliac vessels, but this is not usually indicated. Secure hemostasis with 4–0 braided nylon or clips. Place a sump suction drain into the bed of dissection via a stab incision superior to the surgical incision in order to ensure adequate dependent drainage. All nodal tissue from the common iliac to the distal margin of the femoral triangle should now be excised close to the incision in the external oblique with 2–0 braided nylon.

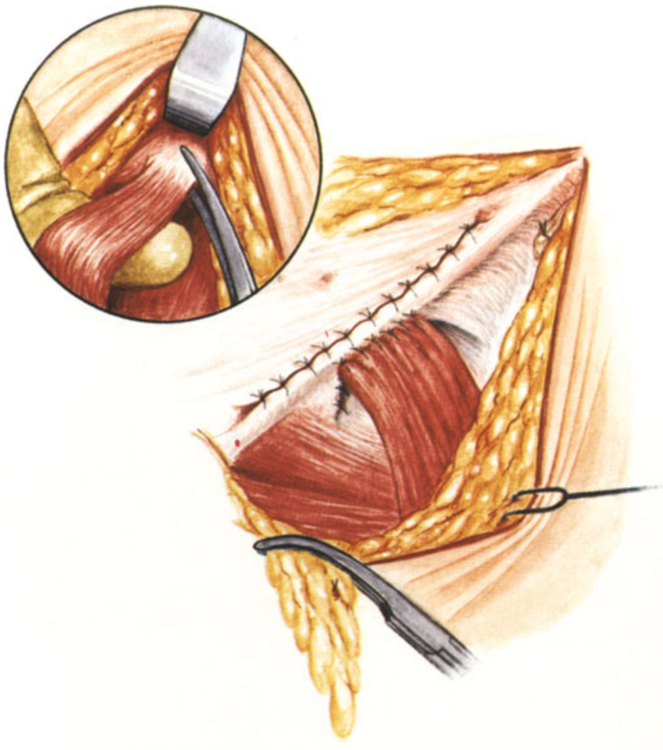


FIGURE 14-13. Unless a myocutaneous flap is to be used for closure of the groin defect, the transposition of the sartorius muscle to cover the femoral vessels should be carried out following closure of the incision along the course of the inguinal canal. Insert a finger beneath the sartorius muscle and incise the fascia lata on the lateral aspect of this muscle. With retraction to expose the easily palpable anterior superior iliac spine, the sartorius muscle may be traced to its tendinous insertion to this spine; transect the tendon from the bone. *Inset:* Place the muscle in gentle medial traction and incise the fascial attachments laterally with care to preserve the blood supply that enters on the medial deep surface of the muscle. Mobilize the muscle until its tendinous insertion reaches the inguinal ligament overlying the femoral vessels. Close the femoral canal to prevent postoperative femoral herniation with 2–0 braided nylon and suture the tendinous insertion of the sartorius muscle to the inferior margin of the inguinal ligament with braided nylon or absorbable suture.

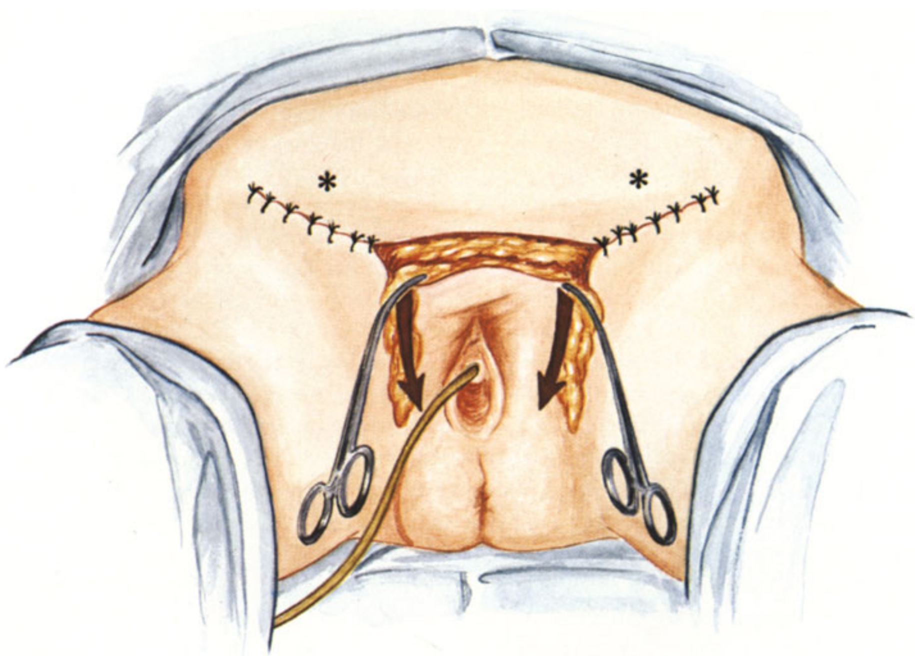


FIGURE 14-14. Initiate closure of the groin incisions by suturing of the superficial fascia of superior and inferior skin flaps to the underlying muscle and fascia in such a fashion as to oppose skin edges as closely as possible while obliterating underlying dead space. Avoid suturing margins of skin and fascia directly to one another as this creates a "bridge" with underlying dead space in which fluid accumulation may occur. Bring all suction catheters out the upper abdominal wall, never through the lower flap. Prior to fascial closure, underlying suction drains are placed through stab incisions. Following the wide excision of skin overlying the groin, as will be necessary in the presence of clinically suspicious or positive nodes or following preoperative irradiation, the use of myocutaneous flaps or primary skin grafts is necessary for closure of the wound defect.

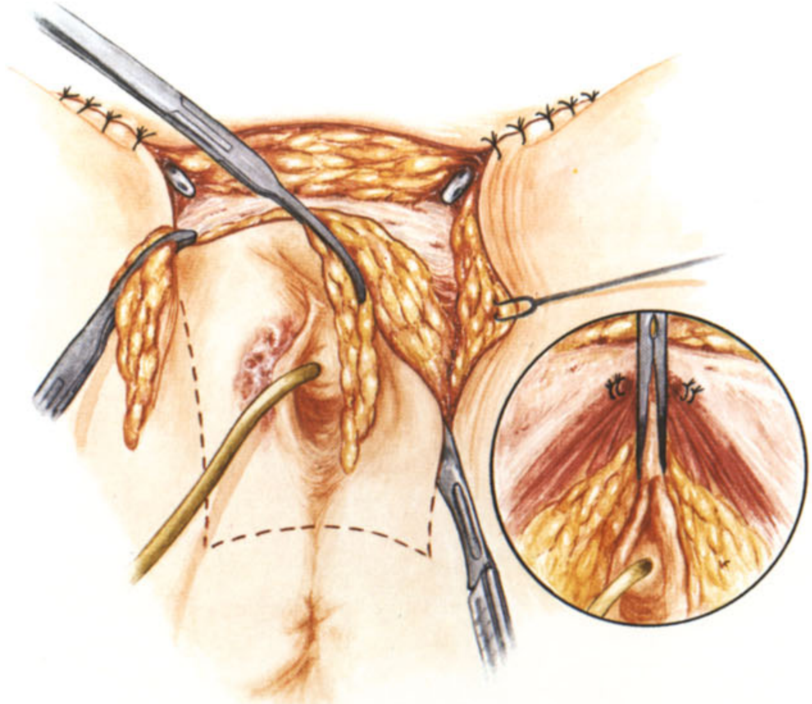


FIGURE 14-15. Planning of the vulvar incision has allowed for adequate margins of excision of the primary lesion as well as skin, adipose tissue, and lymphatics medial to the labiocrural fold to encompass pathways of metastasis. Blunt digital dissection beneath the labiocrural folds along the pectineus and adductor fascia undermines and mobilizes the lateral extent of the vulvectomy specimen. Scalpel incision of the skin completes definition of the line of excision. Use the cautery to significantly decrease blood loss in dissection of the underlying tissues directly down to the level of the fascia. Reflect the specimen inferiorly by sharp dissection across the pubis to identify the base of the clitoris and insertions of the bulbocavernosis muscles lateral to this structure. *Inset:* Each vessel is clamped, divided, and sutured. Take particular care to secure the dorsal vein of the clitoris passing beneath the pubic symphysis.

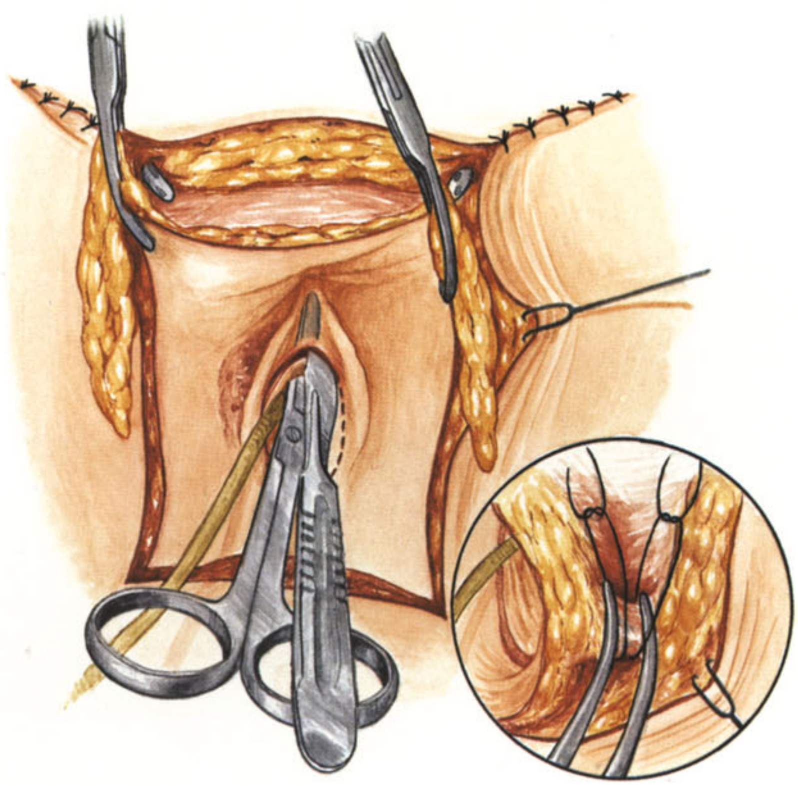


FIGURE 14-16. Sacrifice the distal third of the urethra for lesions in proximity to this structure. Otherwise, preserve the urethra by incising approximately 1 cm anterior to the meatus. Define a plane of dissection at this point to the deep fascia and pubic symphysis. Incise and mobilize the lateral margins of the vulvectomy specimen: *Inset:* Identify the perineal branches of the external pudendal artery on the posterior lateral and deep aspect of the vulvectomy specimen and secure these with 2–0 braided nylon. Proceed from the anterior point of vulvectomy incision anterior to the urethral meatus to incise along the introitus or vagina. The initial incision line should be contralateral to the malignant lesion in order that the vulvectomy specimen may be mobilized and the vaginal margin adjacent to the vulvar lesion clearly visualized.

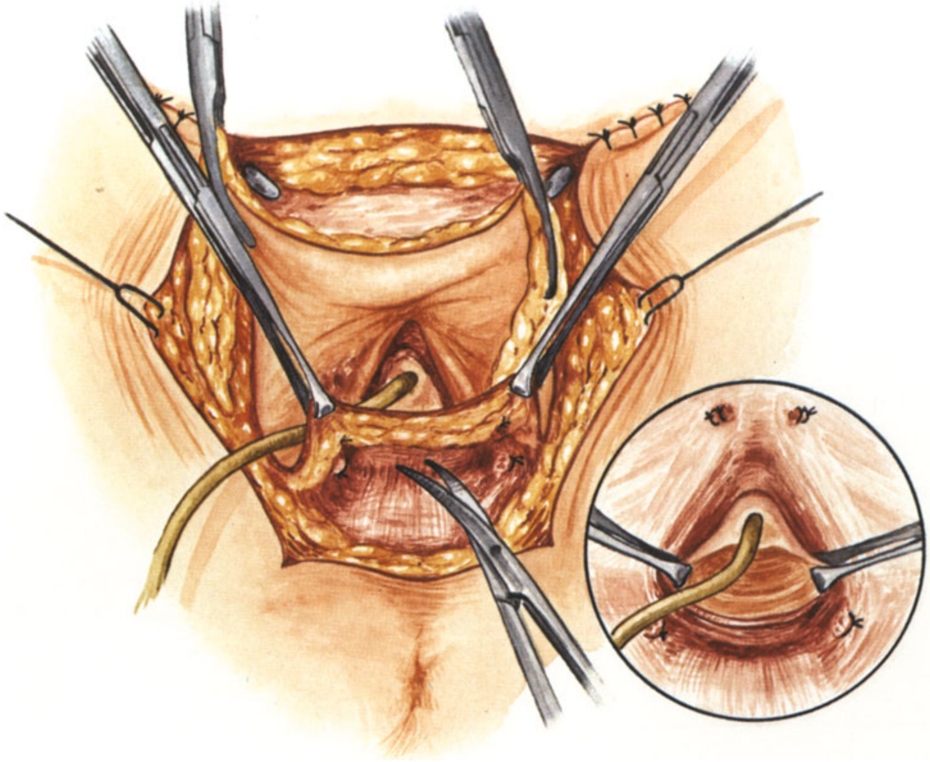


FIGURE 14-17. Incise the posterior line of excision to the transverse perineus muscle and fascia while reflecting the specimen anteriorly. Mobilize the vagina from the rectum for an adequate margin for incision of the lesion and for utilization of some of the posterior vagina for closure of the perineal defect. *Inset:* Following excision of the specimen, mobilization of the vaginal margins facilitates subsequent closure. Have the pathologist examine the specimen for adequacy of deep margins. Secure hemostasis with 3–0 absorbable suture ligatures and cautery. Suture the levator muscle into the midline to strengthen the perineum.

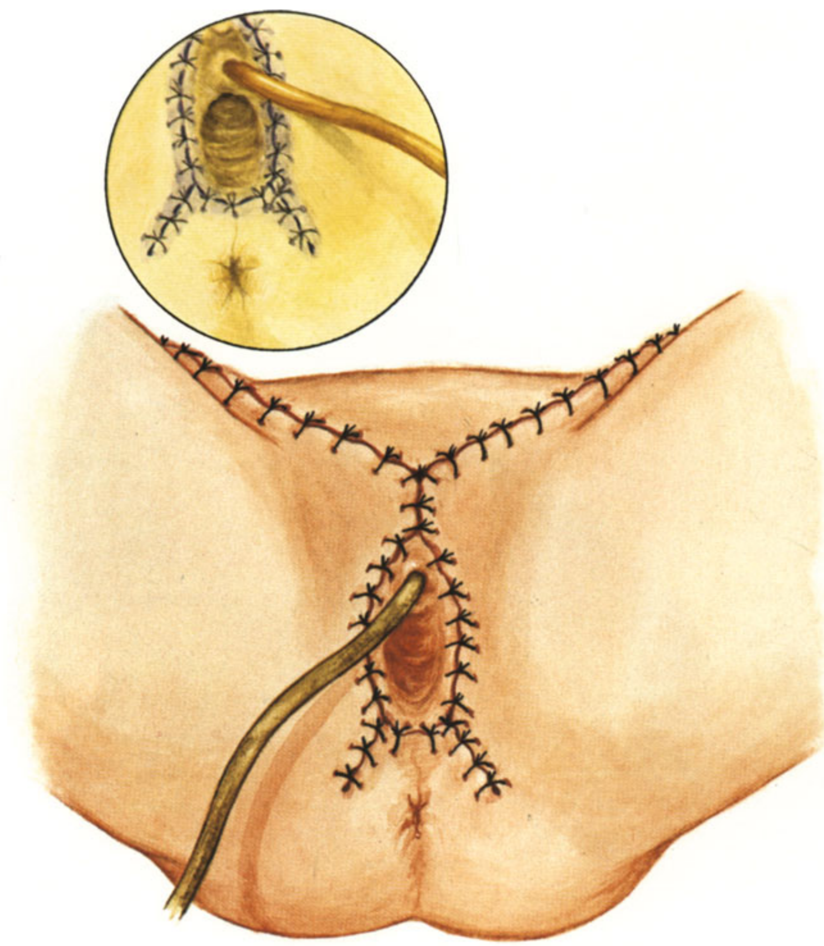


FIGURE 14-18. Assure hemostasis and place suction tubes beneath lateral skin flaps mobilized from the medial aspect of the thigh. Closure of the wound defect should avoid undue tension on the suture lines, which may necessitate primary or delayed split-thickness skin graft, use of relaxing incisions, pedicle skin grafts, or myocutaneous flaps for closure in more extended cases. Use interrupted 3–0 monofilament nylon sutures. *Inset:* Inject the patient with 3 to 5 mL of fluorescein on completion of skin closure and observe under Wood's light. Areas of nonviability that fail to fluoresce should be excised, revised, or grafted. Do not use pressure on delicate wound edges. Instead, rely on suction drains to remove fluid and obliterate dead space.

the inguinal nodes. This resection is rarely omitted, and then only in those patients in whom the added operating time is a serious threat to life.

As lymph nodes fill with cancer the collateral lymphatics fill and widespread retrograde metastases occur, particularly into the cutaneous lymphatics, thus increasing the risks of local and groin recurrence. The use of separate groin incisions rather than en bloc resection has been advocated and seems to have low risk of local recurrence with N0N1 nodes.[8] Whereas unsuspicious nodes (N0N1) are rarely associated with recurrence in the operative site, in patients with N2 or N3 involved nodes, cancer recurs in the groin incision 40% or more of the time.[6] Therefore, if a large suspicious node is present, obtain a percutaneous needle biopsy specimen. If the results are positive, the author prefers to perform an extraperitoneal exploration of periaortic nodes, as well as an examination of the peritoneal cavity and abdominal organs.[21]

In the absence of abdominal disease, begin an extensive course of radiation therapy that includes 5,000 rads midplane to the pelvis and 5,000 rads at a depth of 0.5 cm in the groin. Vulvectomy and groin dissection with compound myocutaneous flaps[5] based on the gracilis or tensor fascia lata are then performed (Figs. 14-19 through 14-23). Improved local, regional, and pelvic control of disease and prompt wound healing have been observed with this technique. These pedicle flaps bring an intact blood supply to a vascular bed compromised by irradiation and are integral to the healing of the groin wounds.

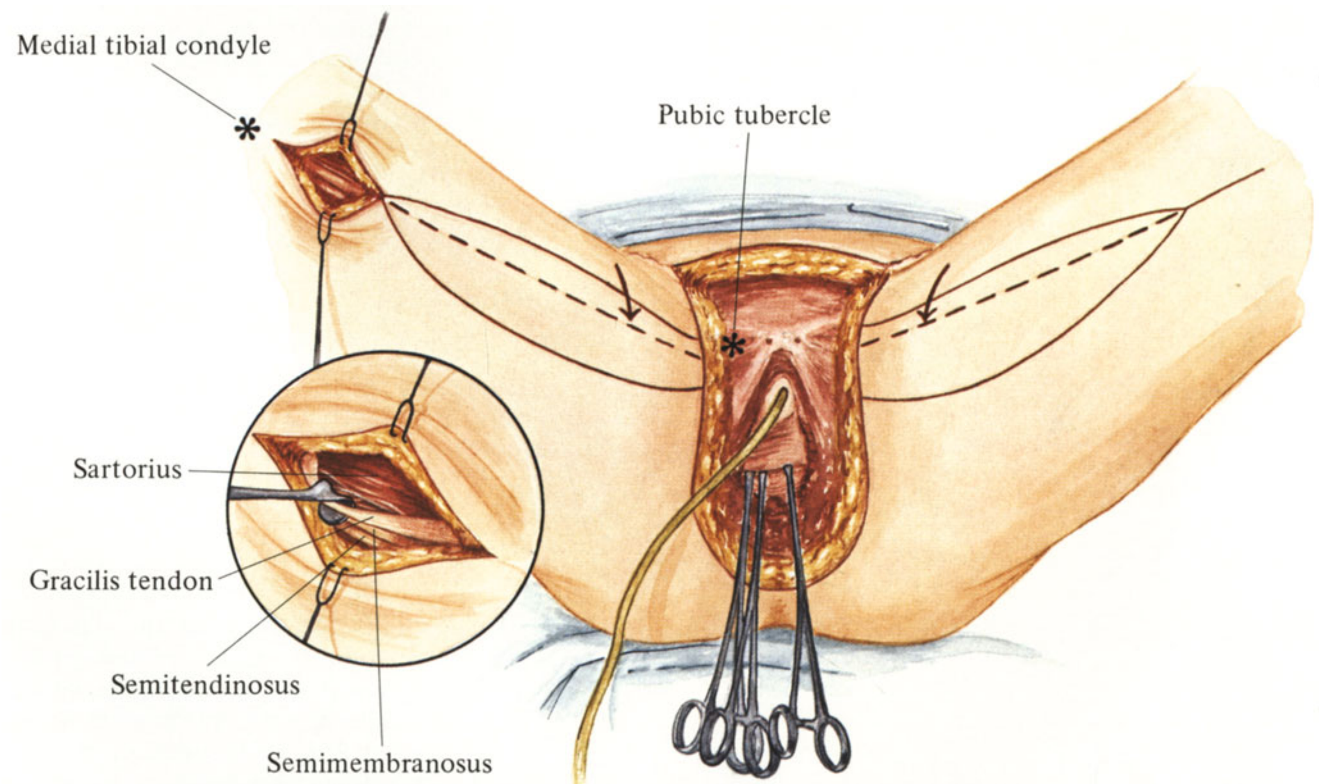


FIGURE 14-19. The gracilis muscle flap technique as performed by Dr. Foad Nahi.[16] The gracilis muscle lies below a line drawn from the pubic tubercle to the medial tibial condyle(*). The associated myocutaneous unit is outlined. The blood supply enters from the ascending branch of the medial femoral circumflex branch of the profunda femoris artery (*arrow*). *Inset:* Incise above the knee and identify the tendon of the gracilis between the sartorius anteriorly and the fascia of the semimembranosus posteriorly. Pull downward on the tendon, identify the overlying skin island, and outline it with a marking pen.

FIGURE 14-20. Cut the gracilis tendon, begin to elevate the flap distally, and incise inferiorly along the outline of the unit through the skin and fascia. Identify and ligate the two inferior vascular pedicles, which are branches of the superficial femoral artery. Preserve the vessels indicated at the arrow. Suture the skin to the underlying muscle with absorbable suture.

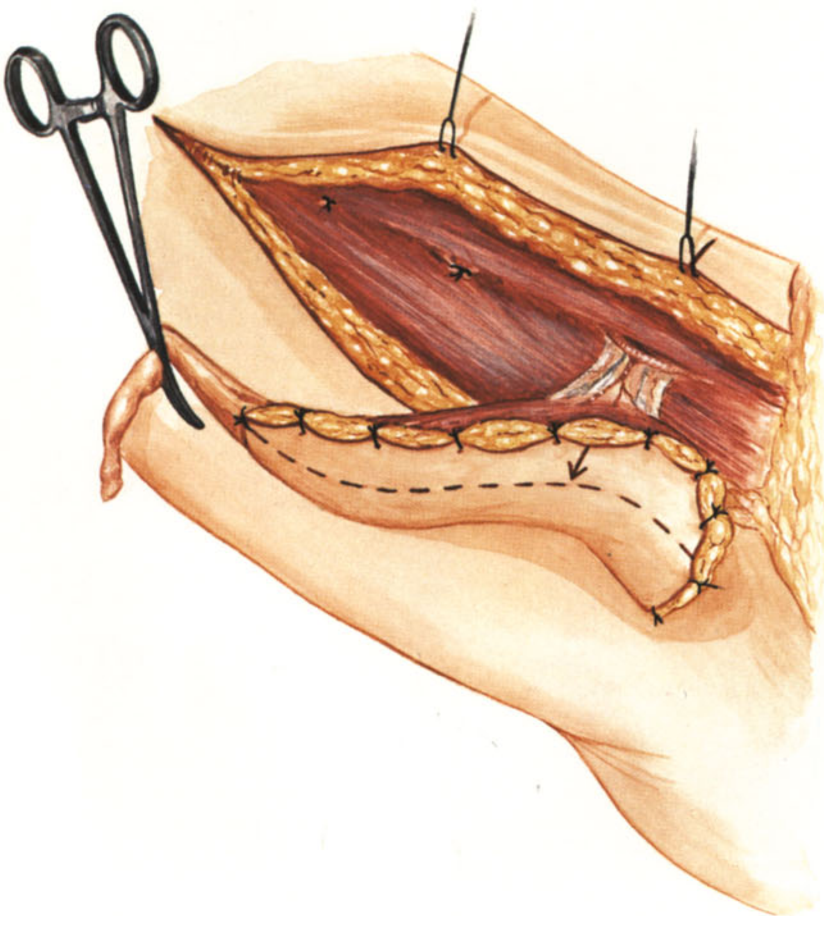


FIGURE 14-21. Carry the dissection sharply to the major vascular pedicle, which emerges deep to the adductor longus and enters the gracilis on its medial surface. Preserve this artery and its accompanying vein, the ascending branch of the medial circumflex. Complete the dissection. The flap is now free to close large defects of the vulva and groin. Approximate the thigh incision with 3–0 absorbable and 3–0 nylon sutures in the skin. Suture the flap in position, avoiding excess tension or injury to the vascular pedicle.

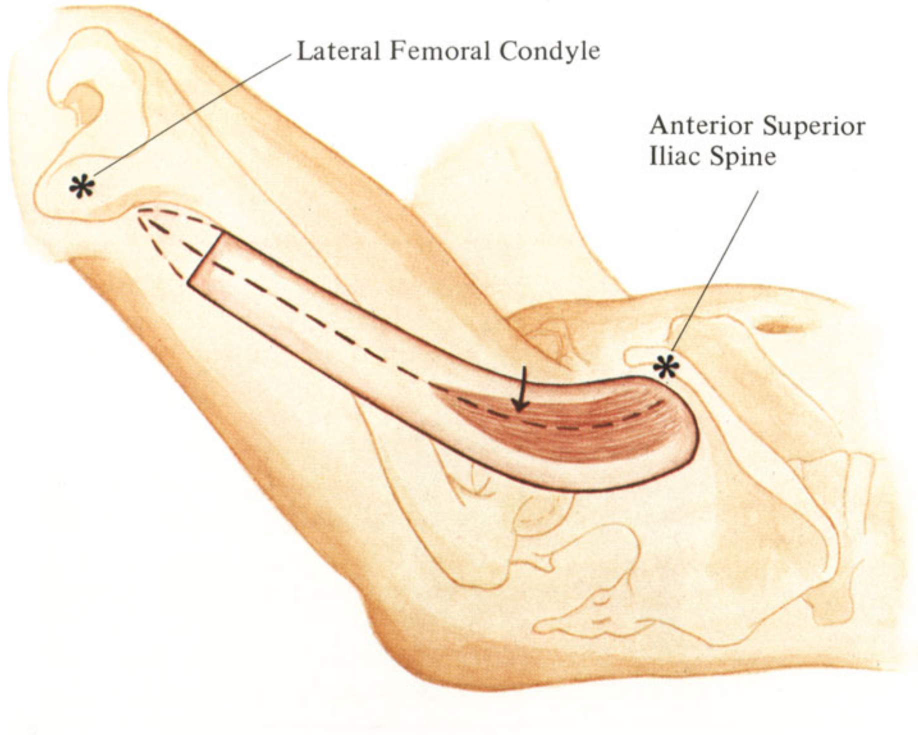


FIGURE 14-22. When lateral coverage is needed, the tensor fascia lata flap may be chosen. While mostly tendon, this small muscle has an excellent blood supply to the skin from the profunda femoris (*arrow*) along the entire length of the flap. Identify the anterior superior iliac spine and the lateral femoral condyle. Identify the tendon and clamp it. Mark the skin margin with a pen and, beginning distally, incise through skin and fascia and elevate the flap, which will be 6 to 10 cm in width along its entire length.

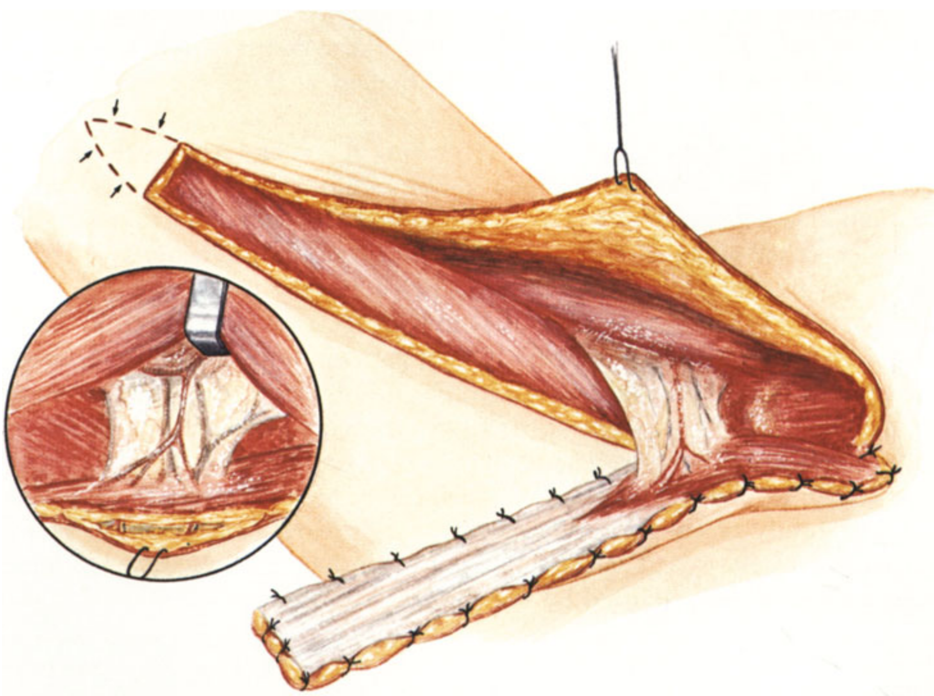


FIGURE 14-23. Continue upward, separating the flap. Blunt dissection may be used as there are no perforators. Dissect the muscle sharply from the gluteus minimus and suture the skin edges to the fascia. *Inset:* The vascular pedicle lies deep to the rectus femoris and enters the tensor fascia lata on the medial aspect. The lateral femoral circumflex artery supplies the tensor fascia lata and divides into three branches before entering the muscle. Note the skin hook exposing the abundant perforation providing excellent blood supply to the skin. If this flap is to be rotated under an existing skin bridge, excise skin and leave subcutaneous tissue to preserve perforators. Rotate the flap at the pedicle to cover large groin or vulvar defects. Trim the distal end and close with 3–0 absorbable suture and 3–0 nylon in the skin approximating the defect.

It is sometimes suggested that in poor-risk patients groin dissection should be delayed awaiting the clinical appearance of metastasis. Morley showed absolute 5-year survival rates of 60% with radical vulvectomy alone, as compared with 85% with radical vulvectomy and groin dissection.[17] Furthermore, there is a 20% higher rate of incisional recurrence following surgery performed when metastasis becomes clinically overt. In addition, the 80% to 90% 5-year survival with occult nodal metastasis drops to less than 50% after removal of clinically suspicious or positive lymph nodes. Finally, the risk of positive pelvic nodes is minimal with N0 or N1 nodes, but where nodal metastases are larger and/or multiple, the possibility of spread to distant sites outside the planned treatment field is greatly increased.[7]

Pelvic Lymphadenectomy

Pelvic lymphadenectomy is selectively employed in vulvar cancer where a significant probability of pelvic nodal metastasis exists. Metastasis from squamous cell carninoma to the pelvic lymph nodes bypassing the inguinal lymphatics occurs in less than 3% of patients and occurs only after extensive and/or multiple nodal metastases. The clinical status of the inguinal nodes accurately reflects the probability of pelvic lymph node metastasis.[6,7,9] Of 85 patients who underwent pelvic lymphadenectomy, 10 of 11 patients with positive pelvic lymph nodes had clinically suspicious N2 or positive N3 inguinal nodes prior to surgery.[6] The remaining patient had a metastasis to Cloquet's node within the femoral canal. Of the 50 patients with negative Cloquet's nodes, none had pelvic metastasis at lymphadenectomy or at subsequent follow-up. Of 5 patients with positive Cloquet's nodes (the highest of the groin nodes medial to the femoral vein), 2 had pelvic lymph node metastasis.

Additional information is obtained at the time of inguinal lymphadenectomy. The presence or absence of enlarged nodes within the specimen is valuable information in determining the risk of pelvic metastasis. Obtain frozen sections of any enlarged nodes in the specimen as well as both Cloquet's nodes. If any are positive the patient should have a pelvic lymphadenectomy. The absolute survival rate after positive pelvic lymphadenectomy is 12.5% to 25%.[6,7,9]

As surgery cures only 20% of the 16% of patients who have pelvic metastasis, very few patients benefit from routine pelvic lymphadenectomy.[7,9,10] Recognition of the factors that increase the risk of metastasis to pelvic lymph nodes and selective pelvic lymphadenectomy is a better approach to treatment.

Success in surgical management of vulvar abnormalities depends on precise diagnosis, study of the anatomic pathways of spread, careful design of the excisional procedure, and use of the newer reconstructive techniques to minimize the disabilities produced by the surgical excision.

References

1. Boehm F, Morris McLJ: Paget's disease and apocrine gland carcinoma of the vulva. *Obstet Gynecol* 1971; 38:185–192.
2. DiSaia, PH, Creasman WT, Rich WM: An alternate approach to early cancer of the vulva. *Am J Obstet Gynecol* 1979; 133:825–832.
3. DiSaia, PH, Rutledge F, Smith JP: Sarcoma of the vulva—Report of 12 patients. *Obstet Gynecol* 1971; 38:180–184.
4. Forney JP, Morrow CP, Townsend DE, et al: Management of carcinoma in situ of the vulva. *Am J Obstet Gynecol* 1977; 127:801–806.
5. Franklin EW, Bostwick J, Burrell MO, et al: Reconstructive techniques in radical pelvic surgery. *Am J Obstet Gynecol* 1977; 129:285–292.

6. Franklin EW, Rutledge FD: Prognostic factors in epidermoid carcinoma of the vulva. *Obstet Gynecol* 1971; 37:892–901.
7. Hacker NF, Berek JS, LaGasse LD, et al: Management of regional lymph nodes and their prognostic influence in vulvar cancer. *Obstet Gynecol* 1983; 61:408–412.
8. Hacker NF, Leuchter RS, Berek JS, et al: Radical vulvectomy and bilateral inguinal lymphadenectomy through separate groin incisions. *Obstet Gynecol* 1981; 58:574–578.
9 Hoffman JS, Kumar NB, Morley GW: Microinvasive squamous carcinoma of the vulva: Search for a definition. *Obstet Gynecol* 1983; 61:615–618.
10. Hugh J, Dinh TV, Woodruff JD: Verrucous carcinoma of the vulva: Study of 24 cases. *Obstet Gynecol* 1982; 60:462–466.
11. Japaze H, Garcia-Bunnuel R, Woodruff JD: Primary vulvar neoplasia—A review of in situ and invasive carcinoma. *Obstet Gynecol* 1977; 49:404–411.
12. Jasionowski EA, Jasionowski P: Topical progesterone in treatment of vulvar dystrophy. *Am J Obstet Gynecol* 1977; 127:667–670.
13. Jones DP: Lymphatics of the vulva. *J Obstet Gynaecol Br Comm* 1963; 70:751–765.
14. Julian CG, Callison J, Woodruff JD: Plastic management of extensive vulvar defects. *Obstet Gynecol* 1971; 38:193–198.
15. Magrina JF, Webb MJ, Gaffey TA, et al: *Stage 1 Squamous Cell Cancer of the Vulva—Prognostic Factors and Treatment.* Central Association Meeting, Kansas City, Missouri, 1978.
16. Mathes SJ, Nahi F: *Clinical Atlas of Muscle and Musculoskeletal Flaps.* St. Louis, Mosby, 1979.
17. Morley GW: Infiltrative carcinoma of the vulva: Results of surgical treatment. *Am J Obstet Gynecol* 1976; 124:874–888.
18. Podratz KC, Gaffey TA, Symmonds RE, et al: Melanoma of the vulva: An update. *Gynecol Oncol* 1983; 16:153–167.
19. Report of the Committee on Terminology: New nomenclature for vulvar disease. Proposal of the International Society for the Study of Vulvar Disease. *Obstet Gynecol* 1976; 47:122–124.
20. Rutledge F, Boronow RC, Wharton JT: *Gynecologic Oncology.* New York, Wiley, 1976.
21. Schellhas HF: Extraperitoneal para-aortic node dissection through an upper abdominal incision. *Obstet Gynecol* 1975; 46:444–447.
22. Thornton WN, Flanagan WC: Pelvic exenteration in the treatment of advanced malignancy of the vulva. *Am J Obstet Gynecol* 1973; 117:774–781.
23. Wharton JJ, Gallager S, Rutledge FN: Microinvasive carcinoma of the vulva. *Am J Obstet Gynecol* 1974; 118:159–162.

Selected Bibliography

Chung AF, Woodruff JN, Lewis JL: Malignant melanoma of the vulva: A report of 44 cases. *Obstet Gynecol* 1975; 45:638–646.

Green TH, Ulfelder H, Meigs JV: Epidermoid carcinoma of the vulva: An analysis of 238 cases. Part I, Etiology and diagnosis. Part II, Therapy and end results. *Am J Obstet Gynecol* 1958; 75:848–864.

Julian CG, Callison J, Woodruff JD: Plastic management of extensive vulva defects. *Obstet Gynecol* 1971; 38:193–198.

McAdams AJ, Kistner RW: The relationship of chronic vulvar disease, leukoplakia, and carcinoma in situ to carcinoma of the vulva. *Cancer* 1958; 11:740–757.

Merrill JA, Ross NL: Cancer of the vulva. *Cancer* 1961; 14:13–20.

Piver MS, Xynos FP: Pelvic lymphadenectomy in women with carcinoma of the clitoris. *Obstet Gynecol* 1977; 49:592–595.

Rutledge F, Smith JP, Franklin EW: Carcinoma of the vulva. *Am J Obstet Gynecol* 1970; 106:1117–1130.

Schellhas HF: Extra peritoneal periaortic node dissection through an upper abdominal incision. *Obstet Gynecol* 1975; 46:444–447.

Shingleton HM, Fowler WC, Palumbo L, et al: Carcinoma of the vulva: Influence of radical operation on cure rate. *Obstet Gynecol* 1970; 35:1–6.

Way SA: *Malignant Disease of the Female Genital Tract.* Philadelphia, Blakiston, 1951.

Way SA: *Carcinoma of the Vulva.* Guest lecture, Society of Gynecologic Oncologists, Jan 1974.

Abdominal Surgery III

Total Abdominal Hysterectomy

15

Hysterectomy is one of the most common operations performed in the United States. The National Center for Health Statistics estimates that 649,000 hysterectomies were performed in 1980. Based on death to case rates of 1 to 2 deaths per 1,000 hysterectomies of all types and for all indications, an estimated 600 to 1,200 hysterectomy-related deaths occurred in 1980.[12] In one large multicenter series, for women of reproductive age undergoing abdominal hysterectomies, the overall complication rate was 42.8 per 100.[10] Attention to specific detail greatly decreases the morbidity from this operation, and this chapter outlines precise measures to minimize injury to the adjacent structures and tissue trauma during total abdominal hysterectomy (Fig. 15-1).

Blood Supply

Arteries

The primary blood supply to the uterus is the uterine artery, which arises either as a separate branch of the internal iliac or more likely as a branch of the superior vesical artery (Fig. 15-2). The uterine artery runs anteriorly and medially across the top of the cardinal ligament over the ureter, to which it gives a small branch, and then divides into cervical, vaginal, and corporal branches. Lesser but important sources of blood supply to the uterus are the ovarian arteries, which arise from the anterior surface of the aorta and travel through the infundibulopelvic ligaments with the ovarian veins. The superior vesical artery, which arises at the termination of the anterior segment of the hypogastric system, is the primary blood supply to the bladder. The superior vesical artery gives branches to the vagina and the lateral side of the bladder before terminating in the umbilical ligament. An easy way to demonstrate this vessel is to grasp the corner of the bladder peritoneum with an Allis clamp and hold it anteriorly on tension; the artery will be seen as a fold in the peritoneum. Once this anterior peritoneum is opened, the area lateral to the superior vesical artery is the paravesical space and the tissue medial to it includes the bladder.

The common iliac artery runs diagonally across the pelvic brim and ends as the internal iliac system and external iliac artery. The latter vessel has no branches in the pelvis, except perhaps muscular branches to the psoas

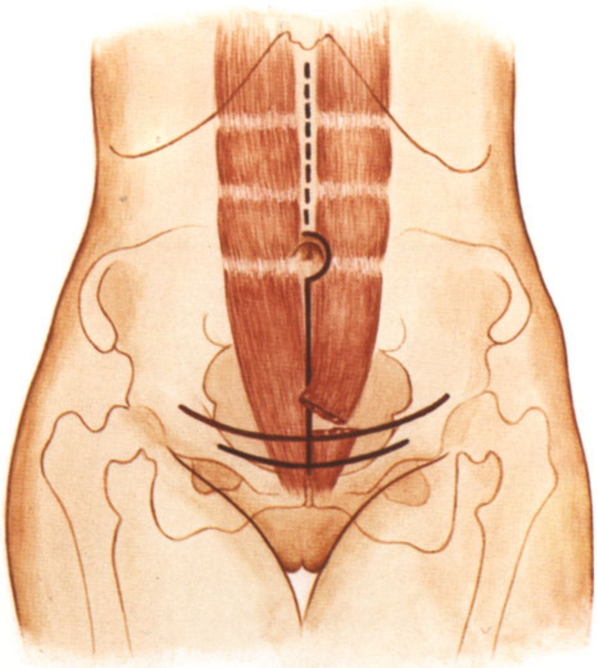


FIGURE 15-1. Basic bony landmarks for the usual incisions in gynecologic surgery.

muscle, until the distal portion of the artery is reached, at which point the circumflex iliac artery arises laterally. Just as the vessel exits under the inguinal ligament, the inferior epigastric artery arises from the anterior medial surface and runs medially and superiorly over the anterior abdominal wall peritoneum.

The pelvic ureter receives branches from the ovarian artery and a branch from the internal iliac artery. This small vessel arises approximately 2 cm from the origin of the internal iliac artery and leaves the artery on its medial anterior surface. It is important to recognize this vessel and preserve it as it is the major source of blood supply to the pelvic ureter. The uterine artery gives a small branch to the ureter as it crosses over and this may be sacrificed. The ureter also receives several branches as it nears the bladder from the vesical system and these likewise may be sacrificed. Occasionally, in older patients, the arteries may lose their elasticity and lengthen. This occurs occasionally in the pelvis as serpiginous common, external, and internal iliac arteries.

Collaterals

The collateral vessels of the pelvis are extensive and of diffuse origin. The anterior division of the internal iliac artery anastomoses with its counterpart from the opposite side, except for the inconstant middle rectal artery; it anastomoses with the superior rectal from the inferior mesenteric and the inferior rectal from the internal pudendal artery. More sizable anastomoses occur with the posterior division of the internal iliac artery; the superior gluteal anastomoses with the circumflex branch of the femoral artery, the lateral sacral anastomoses with the middle sacral from the aorta, and the iliolumbar anastomoses with the lumbar artery from the aorta. With these rich collateral blood supplies, simple internal iliac artery ligation will fail to control pelvic hemorrhage, as illustrated when one ligates both anterior divisions and cuts the uterine artery and then observes the extensive blood flow that remains

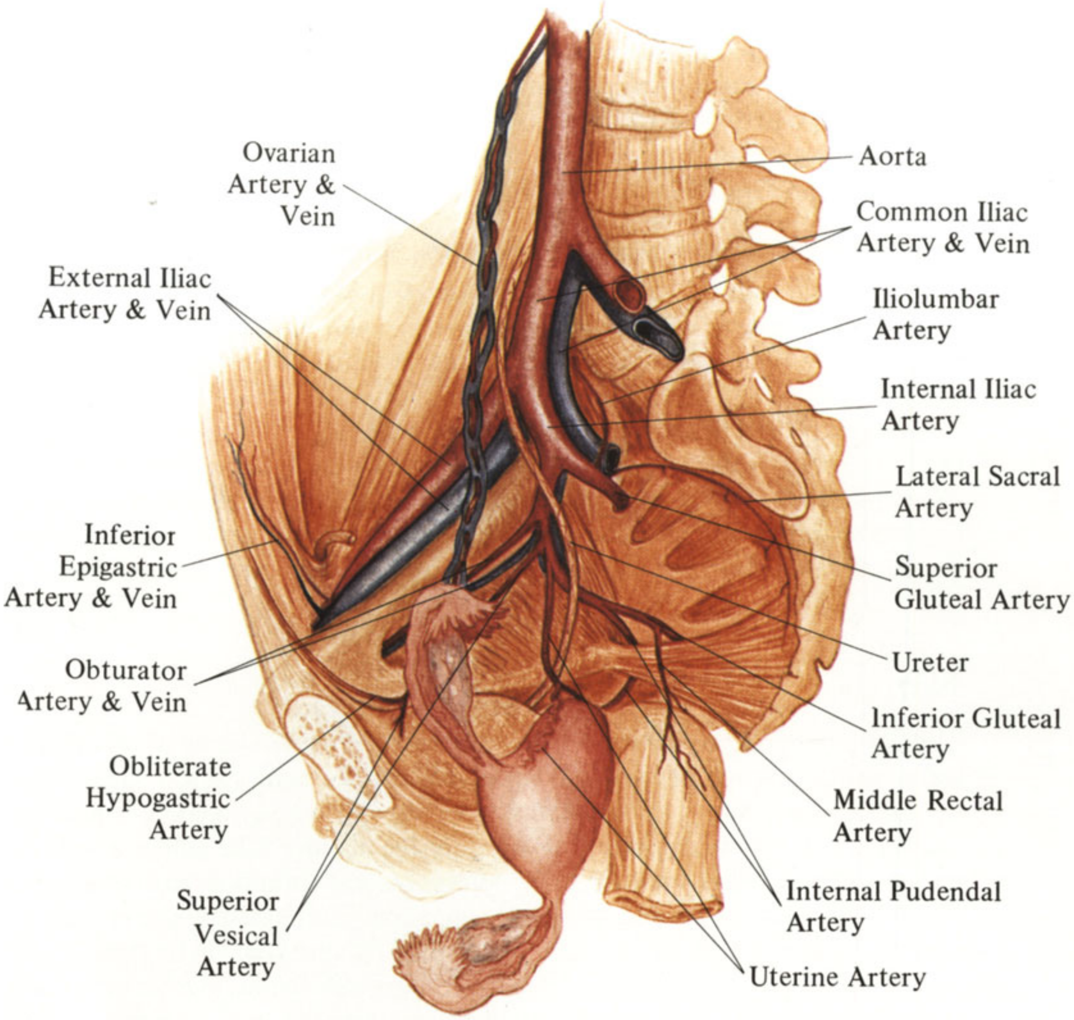


FIGURE 15-2. Common pattern of arterial blood supply to the pelvis. Great variability exists, however, and many major and minor variations have been observed. Observe that all pelvic arteries arise from the internal iliac with the exception of the superior rectal, which arises from the inferior mesenteric and the ovarian and median sacral arteries from the aorta.

through the pelvis. Obviously, internal iliac artery ligation is no substitute for careful identification, isolation, and ligation of a bleeding pelvic vessel.

Veins

The uterine veins leave the uterus laterally and may surround the uterine artery. They travel along the surface and through the substance of the cardinal ligament to enter the pelvic wall plexus and eventually the internal iliac venous system. The ovarian, tubal, and part of the uterine venous blood drains out the infundibulopelvic ligament through multiple veins that ultimately unite and drain into the vena cava on the right and the renal vein on the left. The common iliac vein is formed by the external iliac vein and the internal iliac venous system, which is very variable. The major branch lies lateral and below the artery and drains the cardinal ligament. The circumflex iliac vein generally goes over the external iliac artery but occasionally may go under that vessel. In approximately one-third of cases the obturator vein, instead of following the course of the obturator nerve and artery, turns superiorly just after it enters through the obturator foramen and enters the inferior medial side of the external iliac vein. Watch for this vein during obturator node dissection. Part of the venous drainage from the bladder is included in the lateral cervicovesical ligament, which arises from the corner of the bladder base and enters into the lateral third of the cardinal ligament.

The most difficult bleeding to control in pelvic surgery is venous, and it is probable that most operative deaths from hemorrhage are from venous sources. Most venous bleeders can be isolated and either clamped, clipped, or sutured with adequate exposure and suction. Some, however, will require pelvic packs. Packing of a diffuse venous bleed and proceeding to the opposite side will save significant operating time and produce surprisingly good hemostasis.

One area where pelvic bleeding may be impossible to control with conventional methods is the junction of the gluteal veins and the internal iliac vein. These veins, if torn, may produce bleeding of sizable proportions and may be almost impossible to isolate. In some instances, suture of the adjoining structures, including the sciatic nerve, may be necessary to prevent exsanguination.

Nerves

The sympathetic system descends laterally to the great vessels in the abdomen, forms a plexus over the area of bifurcation of the vena cava, courses over the sacral promontory, divides and follows the uterosacral ligaments to enter the uterus, and continues anteriorly to enter the bladder. The parasympathetic nerves on both sides arise from the upper sacral foramina and transverse the deep portion of the uterosacral ligament on both sides of the rectum to enter the uterus, penetrate through the cardinal ligament, and enter the bladder through the lateral cervicovesical ligament. The genitofemoral nerve runs along the surface of the psoas muscle adjacent and parallel to the lateral surface of the external iliac artery and should be preserved during the lymphadenectomy. Remember that the femoral nerve runs through the substance of the psoas muscle in its pelvic portion; therefore, avoid placing self-retaining retractors laterally on this muscle as they may produce pressure and femoral nerve paralysis (Fig. 15-3). This is of particular concern in the very thin patient

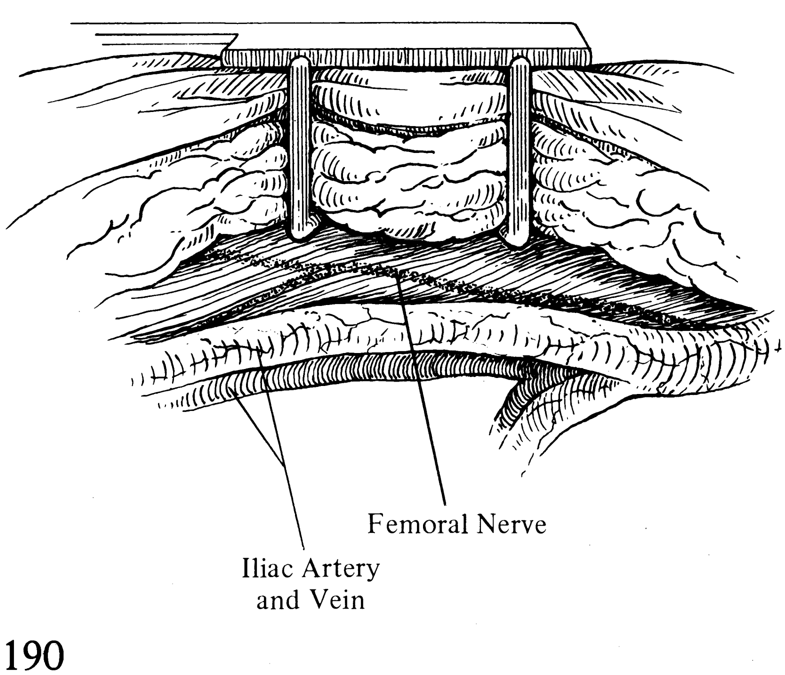


FIGURE 15-3. Shown above is a retractor in an abdominal wound of a slender patient. Note the important relationship to the femoral nerve.

and in the longer surgical procedure, although femoral nerve injury has been reported in very brief surgical events.

The obturator nerve appears from the area lateral to the hypogastric vein and artery, transverses the lateral pelvis through the lateral paravesical fossa, and exits through the obturator foramen. It is accompanied by the obturator vessels. The nerve is several millimeters in diameter and easily identified.

Ligaments

Uterosacral

The uterosacral ligaments are broad structures containing primarily fibrous tissue, some smooth muscle, autonomic nerves, and, in their lower portions, small arterioles from the hemorrhoidal vessels. They encircle the lateral rectum to enter the upper vagina and cervix medially, whereas the lateral fibers join the posterior sweep of the cardinal ligaments. Until one dissects the entire system of uterosacral ligaments, it is difficult to appreciate their broad superior-inferior attachment to the sacrum and uterus-vagina.

Cardinal

The cardinal ligaments arise from the cervix and upper third of the vagina—actually more of the cardinal ligament is attached to the vagina than to the cervix. They sweep laterally and posteriorly to attach to the fascia that covers the sciatic plexus. Keep this in mind if there is bleeding at the base of the cardinal ligaments, as deep sutures may injure the sciatic plexus.

The cardinal ligaments are made up of condensed bands of fibrous tissue, uterine and vaginal veins, lymph nodes, and autonomic nerves. The cervix and vagina are covered anteriorly and posteriorly by a rather dense fascia, which cancer usually only penetrates late in its course. However, the fascia is incomplete laterally at the attachment of the uterosacral and cardinal ligaments; thus the tumor finds its way laterally into the parametria. The parametria is made up of the uterosacral and cardinal ligaments and their attachments. The cardinal ligament divides the paravesical space from the pararectal space.

Bladder Pillars

The medial bladder pillar runs from the anterior surface of the cervix across the upper vagina onto the base of the bladder and contains a small artery.

The lateral bladder pillar (lateral cervical vaginal ligament) is a lateral extension of the medial bladder pillar and arises from the lateral corner of the base of the bladder and swings laterally to join the outer third of the cardinal ligament. This pillar contains ganglia, a large plexus of vesical veins, and the entrance and exit of the bladder's autonomic nervous system.

Spaces

There are two important spaces that must be developed to adequately dissect the lateral pelvic wall, the paravesical space anteriorly and the pararectal space posteriorly. The paravesical space is bound medially by the bladder, anteriorly by the obturator foramen and superior ramus of the pubis, laterally by the obturator internus muscle and the pelvic wall vessels, and posteriorly by the cardinal ligament. Its floor is the junction of the obturator internus muscle and levator ani. Approach it by separating the superior vesical artery from the external iliac vein and artery just anterior to the round ligament and then dissect it inferiorly down toward the pelvic floor, where there is loose areolar tissue (Fig. 15-4). Once this space is opened, the bladder is pushed medially and the space is well developed. The anterior and lateral area is called the obturator fossa.

The pararectal space is bound medially by the rectum. It is bound laterally by the connective tissue and fascia overlying the sciatic nerve and its divisions and by the venous system of the hypogastric vein. Posteriorly it is bound by the sacral hollow and anteriorly by the cardinal ligament. Its floor is the levator ani muscle and the hollow of the sacrum. Enter the space by dissecting medially along the hypogastric artery and pushing the rectum medially, being careful not to sever the artery to the ureter from the hypogastric artery. The uterosacral ligaments will be on its medial wall.

The alterations in the intraperitoneal space caused by pelvic inflammatory disease, endometriosis, and irradiation of malignant disease may distort the anatomic findings. The surgeon may usually depend, however, on a standard anatomic relationship in the extraperitoneal space, and the author recommends this basic approach in gynecologic surgery. As a result of the embryonic development of the female genitalia, round ligaments are a constant structure and are easily found. On dividing the round ligaments and proceeding initially to the extraperitoneal space in abdominal hysterectomy, a ready reference with easy landmarks will be found even in a patient with severe endometriosis with intense distortion of the intrapelvic findings. The peritoneal dissection should be lateral to the ovarian vessels as they enter the pelvis; they will be superior at all times to the ureter, which is easily isolated from them both by palpation and direct visualization. A small vessel extends below the round ligament, which on some patients requires brief cauterization to avoid staining the extraperitoneal space, and the dissection is made infinitely simpler by avoiding any staining through blood loss. Light, fine areolar tissue is an excellent surgical medium but blood-stained extraperitoneal tissue is of little advantage as an operative plane.

Remember that the only vessel in the pelvis that is spiral in its course is the uterine artery, aiding its easy identification. With traction anterior and

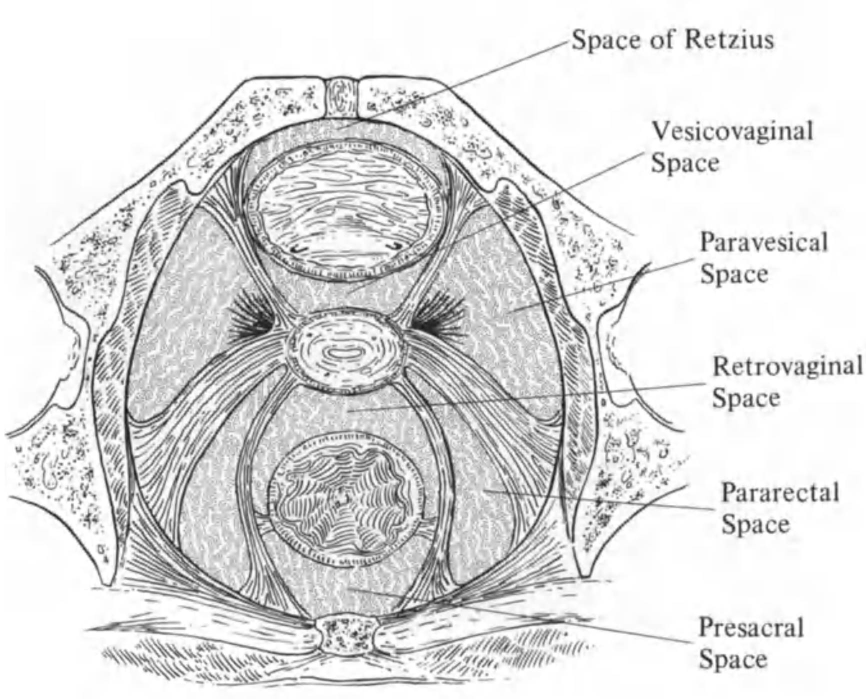


FIGURE 15-4. The pelvic spaces are filled with areolar tissue, as shown by the stippling; they are exposed through traction and the deep placement of retractors.

cephalad on the uterus, the plane between the bladder and the uterus is easily found. Strong traction produces the planes in the pelvis and is an essential factor in any well-done pelvic surgical procedure. Such tension should be planar in type, laying tissues out by layers in a flat surface so that they may be divided with a knife or scissors. Study of a well-done radical neck dissection will aid in visualizing this vital maneuver as the structures are much easier to see in this procedure. On dissecting the bladder from the vagina, the plane will be found in the midline by dissecting down sharply toward the vagina. A few white fibers will be seen in this relatively avascular area. Using this as a reference point, dissection may be carried downward in this plane with very little blood loss. There is another plane of equal use directly in front of the uterine arteries.

Although many descriptions of hysterectomy techniques show dissection of the posterior pelvic peritoneum free of the vagina and cervix to achieve better mobilization of the ureters, a study of the ureters at the time of this dissection will show that they are little affected by this maneuver and all one achieves is additional bleeding. The ureters are best protected by direct visualization and palpation with the uterine arteries divided above the branch to the cervix. If the next clamp is placed medial to this tie, the ureters are free from the field. Uterosacral ligaments may be included in clamps without their separate dissection as the procedure continues down the uterine side wall. The plane between the rectum and the vagina is likewise avascular and is best entered with sharp dissection in the midline. Strong superior uterine traction and inferior rectal traction are useful. The avascular plane extends down the posterior vagina, allowing easy visualization of the anterior rectum.

Preoperative Considerations

Major indications for abdominal hysterectomy include dysfunctional uterine bleeding, leiomyomas, pelvic inflammatory disease, adenocarcinoma of the endometrium, atypical adenomatous endometrial hyperplasia, carcinoma in situ of the endometrium, and adnexal pathology and stress incontinence.

Diagnosis of the abnormality is usually obtained with careful pelvic examination, vaginal cytology, and a well-done endometrial suction curettage. Patients with abdominal bleeding must be carefully studied prior to abdominal hysterectomy to make certain that no undetected cervical, endocervical, or endometrial cancer exists. Biopsy should be done on any cervix of abnormal appearance and always obtain endometrial tissue as endometrial cytology is misleading. Informed consent and patient compliance require a discussion of the rationale of treatment as well as other options for care, associated ancillary measures, and possible complications.

If dysfunctional uterine bleeding persists after diagnostic studies, endometrial biopsy and curettage, and the use of progesterone (the author prefers progesterone in oil), hysterectomy is often sought if the family is completed. Although this can frequently be accomplished with ease by the vaginal approach, it may, on occasion, be desirable to perform the procedure abdominally. Leiomyomas may be present or the patient may have associated adnexal pathology, rendering abdominal excision a more satisfactory technique. Adenomyosis with associated bleeding may also be found. Removal of the ovaries is also recommended in the majority of these patients over 40. If in doubt about ovarian removal, the author would err on the side of aggressive management. The author would remove the ovaries when the uterus is removed and begin estrogen supplementation rather than continue medical care and observation for ovarian abnormalities.

Leiomyomas of the uterus greater than 8 weeks in size are best managed abdominally. Simple leiomyomas may be removed with myomectomy; however, if childbearing is complete, hysterectomy is the preferred procedure. Removal with myomectomy has been associated with the need for subsequent hysterectomy. In two series, 20%[17] and 28.6%[24] of the patients required a subsequent hysterectomy. The incidence of malignancy in leiomyomas is less than 1%[5]; however, the symptoms of pressure, increasing abdominal size, ureteral obstruction, or urinary pressure, or the association of menorrhagia may make hysterectomy the most reasonable method of handling this particular abnormality.

The uterus is usually removed with associated pelvic inflammatory disease as both tubes and ovaries are usually involved. Likewise, if both adnexae are removed for benign or malignant ovarian tumors, the uterus should be removed as well.

An additional indication for uterine removal is surgery for stress incontinence. Patients have better long-term results if the uterus is removed,[15] which should pose no problem if childbearing has been completed.

Adenocarcinoma of the endometrium is a common indication for uterine and ovarian removal. The treatment for endometrial cancer is biphasic, and radiation therapy is an integral part of it. In stage I endometrial cancer the author prefers first to remove the uterus and then, following surgical staging, to treat the patient with radiation therapy. Depending on the findings, therapy may be irradiation of either the total pelvis or vaginal ovoids.

There is little rationale for simple hysterectomy in the management of invasive carcinoma of the cervix. However, early microinvasive cancer of the cervix is well managed with simple abdominal hysterectomy. Christopherson et al reported 111 patients with microinvasive carcinoma of the cervix with unequivocal invasion to a depth of up to 5 mm.[7] The majority were followed 10 years or longer; one patient was lost to follow-up. Of these 110 patients, including 79 treated by simple hysterectomy, none died of cancer of the cervix. Lymphatic or vascularlike space invasion did not affect prognosis. Intense pathologic study of adequate amounts of tissue is essential to arrive at an accurate preoperative diagnosis. There is little justification for unexpected extensive invasive carcinoma in the hysterectomy specimen.

Operative Strategy

Place a Foley catheter in the patient and prepare the patient with a povidone-iodine (Betadine) vaginal and abdominal preparation.

Venous bleeding is greatly decreased through the use of appropriate traction, properly chosen instruments, and suture material as described in Chapter 4. Exposure is obtained in most instances with traction upward from the true pelvis. The author prefers the Masterson clamp for use in the paracervical tissues and for grasping the pelvic tissues. This clamp has fine nontraumatic teeth that hold tissue quite satisfactorily. The usual clamps available, such as the Heaney, Ochsner, and Kocher clamps are needlessly traumatic and produce an unnecessary amount of dead devitalized tissue, as discussed in Chapter 4. Suture material only needs to be as strong as the situation requires and should promote the least tissue reaction. The author recommends fine 3–0 Vicryl or Dexon in the pelvis on the medium-size nontraumatic needle and 2–0 and 3–0 chromic gut for suture material inside the pelvis. Absorbable suture should be used to close the vagina and in the cardinal ligaments; the remainder of the sutures may be 3–0 non-absorbable without significant risk of suture extrusion to the vaginal cuff.

Bleeding from the bladder may be controlled with cauterization or fine 3–0 absorbable ties. Avitene is a most useful adjunct if numerous small bleeders are present deep in the pelvis, but the areas should be relatively dry before it is placed. It is best placed with an open 4 × 4 sponge directly over the bleeder and pressure is applied for 2 minutes after its application. Remove any excess Avitene before closure. A possible association between Avitene and retroperitoneal fibrosis causing ureteral obstruction has been suggested.[8] However, recent laboratory models do not substantiate this association.[21,25]

Another useful instrument is the flexible fiberoptic light source that may be placed directly in the wound. It significantly illuminates the deep recesses of the pelvis without constant manipulation of overhead lights.

Operative Technique

The abdominal incision is chosen on the basis of the patient's weight, the disease process involved, and the height of the pubic symphysis. If the symphysis is very high, a low transverse incision may lend much more exposure to the distal pelvis than a midline incision, and all factors should be carefully evaluated before the incision is made.

In the very obese patient a carefully planned incision assumes even more importance. When the patient is more than 400 pounds, every opportunity to avoid an abdominal surgical procedure should be considered. However, when surgery is necessary, certain measures are helpful.

Huge panniculus may be entirely avoided by making certain that the incision is based on the upward margin of the symphysis rather than some site distal from the abdominal apron. Meticulous incising with minimal trauma in the fatty layer is essential to reduce complications. The surgeon may be surprised to find remarkably good exposure and an easy abdominal hysterectomy in a well-visualized, though distant site. Deep instruments are essential as is a self-retaining retractor with very deep blades. An additional assistant is very useful. One need not drain the large abdominal wound and subcutaneous sutures are best avoided.

Mortality for the massively obese commonly results from pulmonary complications and their management and usually does not involve the surgical wound. Smead-Jones closure is essential. External retention sutures through the massive panniculus only result in maceration of the skin and subsequent infection.

The author prefers to stand on the patient's left side with his assistant on the patient's right, second assistant to the surgeon's left side, and scrub nurse to the right of the first assistant. The surgeon proceeds with the incision and follows the procedure illustrated in Figs. 15-5 through 15-22.

Endometriosis

Although 17% of abdominal surgical patients have pelvic endometriosis, fewer than one-half of these patients have symptoms referable to this disease. Some patients with extensive masses may be relatively asymptomatic, while other patients with a small amount of endometriosis more strategically located have severe symptoms.

Carter outlined information necessary to determine appropriate therapy in pelvic endometriosis: the desire for children, age of the patient, duration of infertility, severity of symptoms, and associated pelvic pathology must all be considered as well as the extent of endometriosis.[6] Hammond's modification of Acosta's classification of endometriosis is useful (Table 15-1). In 1985 the

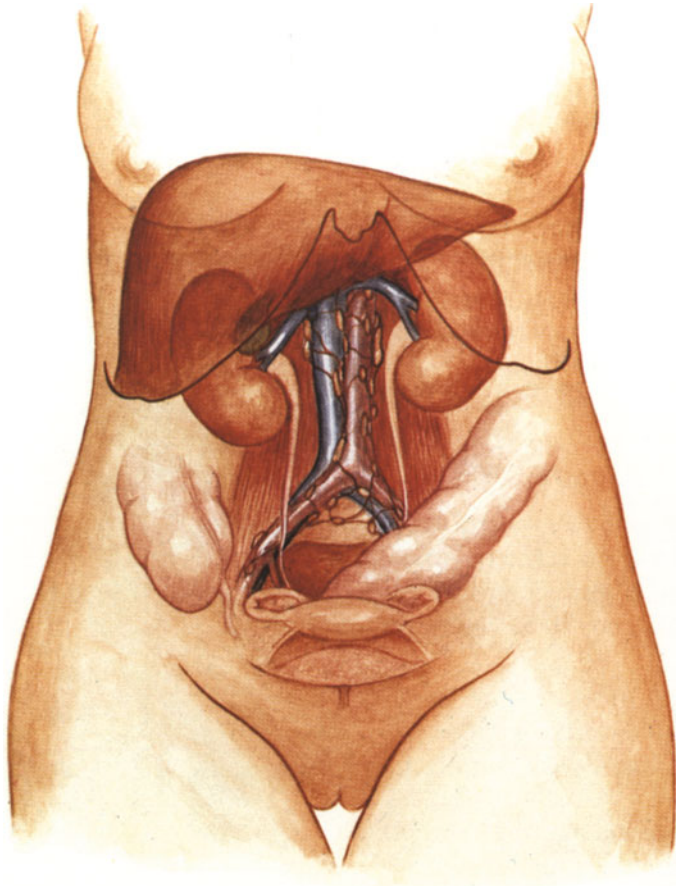


FIGURE 15-5. Observe, explore, palpate, and later record the status of the peritoneum, omentum, liver, gallbladder, stomach, small and large bowel, kidneys, ureters, para-aortic and pelvic lymph nodes, uterus, tubes, and ovaries.

FIGURE 15-6. Enter the abdomen with a knife, incising to the fascia. Make the skin incision longer than the fascial incision, and the fascial incision longer than the peritoneal incision. Make the entire incision with a knife, laying the tissues out in a planar fashion. There is no need for scissors. Do not dissect laterally between the fascial planes. Keep the incision margin smooth to avoid dead spaces in the wound. With the aid of a long Deaver retractor, strong upward traction, and a fiberoptic light source placed well into the wound, carefully inspect the abdominal and pelvic structures. This is a vital part of any laparotomy. A surgical specialist is not excused from recording a thorough exploration of the entire abdominal and pelvic viscera.

FIGURE 15-7. Following exploration, place damp laparotomy tapes over the wound margin and install a self-retaining retractor over the wound edges. Take care to use the appropriate blade lengths and to correctly position the retractor so as to avoid pressure deep on the lateral pelvic wall with possible subsequent femoral nerve palsy. Grasp the uterus with two Masterson clamps, pull upward, and pack the abdominal viscera out of the wound. Pack the cecum with one laparotomy tape on the right. Place folded tape over the small bowel and push upward. The remaining tape packs the left gutter and fixes the sigmoid in place. Place a wide pelvic Deaver retractor on the upper part of the wound to aid in exposure.

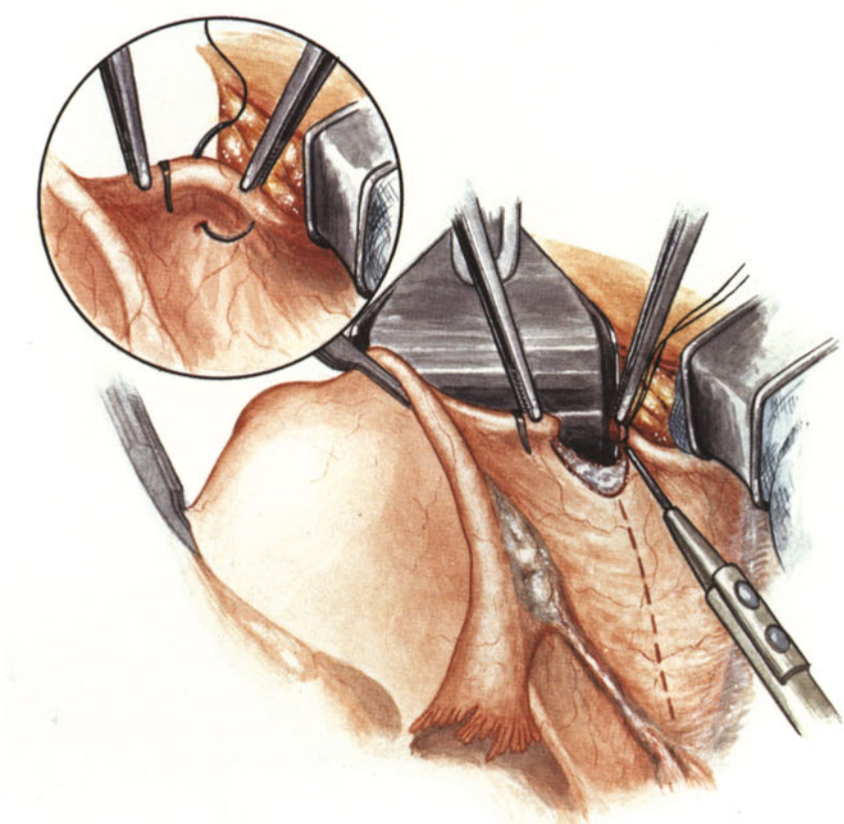


FIGURE 15-8. Pull the uterus upward; place a clip on the proximal round ligament and a 3–0 absorbable suture beneath the round ligament; divide the ligament with a knife. *Inset:* Cauterize the small, rather constant artery running in the areolar tissue below the round ligament. Pull the uterus upward to the left using delicate 10-inch Nelson scissors and Adson-Brown forceps, carrying the dissection lateral to the ovarian vessels and being careful to avoid the external iliac artery.

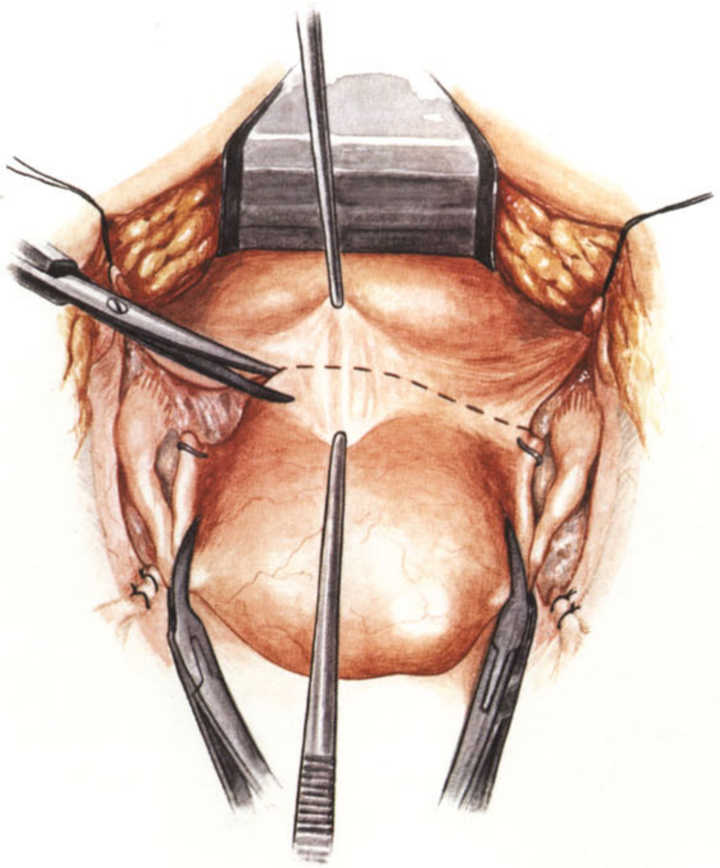


FIGURE 15-9. Using strong upward traction and tension between long Adson-Brown thumb forceps, dissect between the two round ligaments.

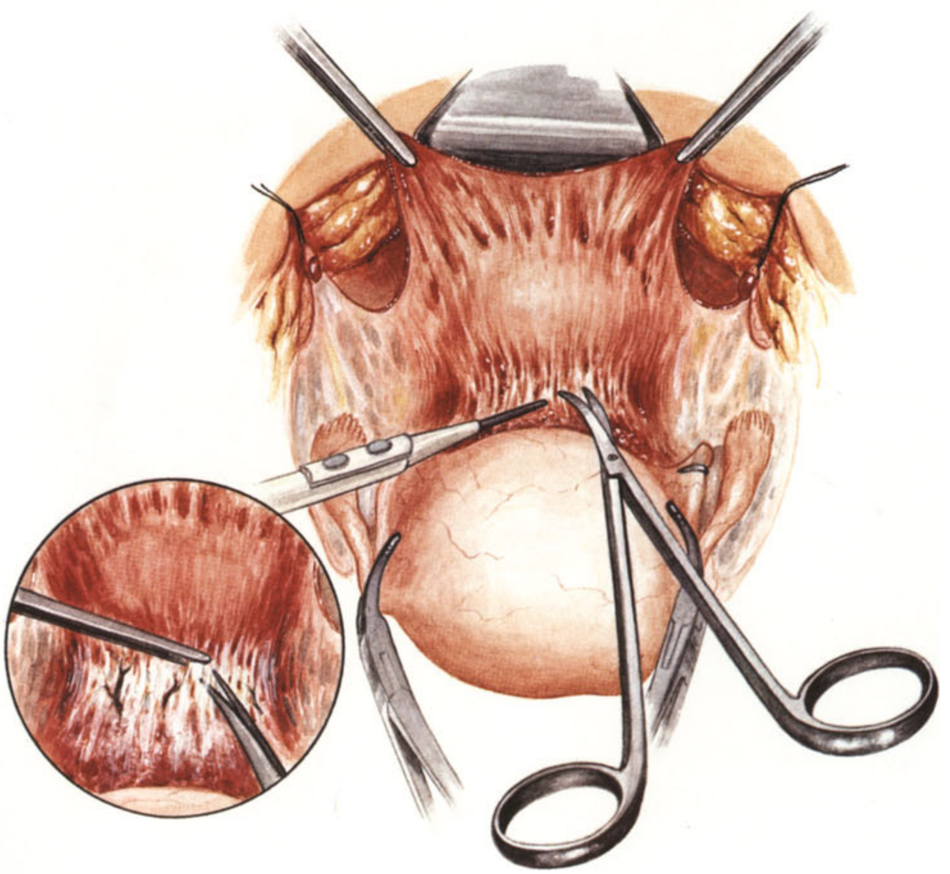


FIGURE 15-10. Grasp the peritoneum and upper surface of the bladder with Adson-Brown thumb forceps and pull strongly upward and anteriorly. Pull the uterus backward, exposing the plane between the bladder and cervix. Precise entrance of this plane is vital to the safety and ease of conduct of this operation. Pushing a laparotomy tape downward is a poor substitute for precise dissection. Use the cautery for small venous bleeders in this area. Constant planar traction on the field makes the dissection much easier. *Inset:* Observe the specific nature of this plane. Its white, rather avascular nature is an aid in this dissection.

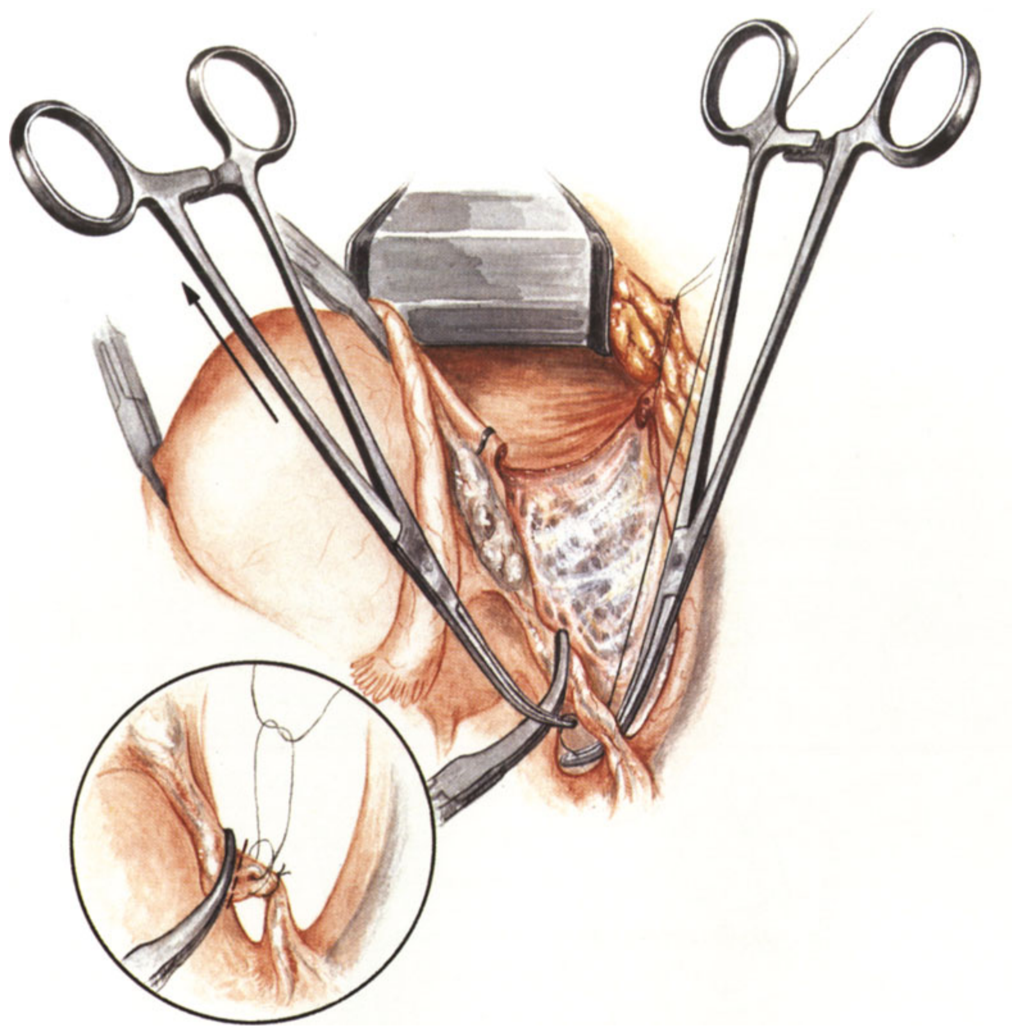


FIGURE 15-11. If the bladder dissection produces bleeding, place a dry laparotomy sponge anterior to the uterus, which will exert some pressure on this bleeding during this phase of the ligation of the ovarian vessels. Isolate the ovarian vessels, identify the ureter as it lies below the ovarian vessels, and ligate them with 2–0 or 3–0 suture. Place the proximal tie around the ovarian vessels and tie. *Inset:* Pass the next suture through the structure to fix it. Place a single throw using a Gemini clamp; grasp the opposite end, pull upward, and ligate. Cut the distal sections, pull upward, and either clip or leave them with the clamp. There should be no question as to the strength of these ligatures; always adhere to the policy of double ligation of the ovarian vessels due to the tendency of these vessels to retract, particularly the ovarian artery, which lies in the center of these venous structures. If hematoma occurs, the peritoneal dissection is continued laterally above the area of hematoma and the procedure is performed again, obtaining secure hemostasis.

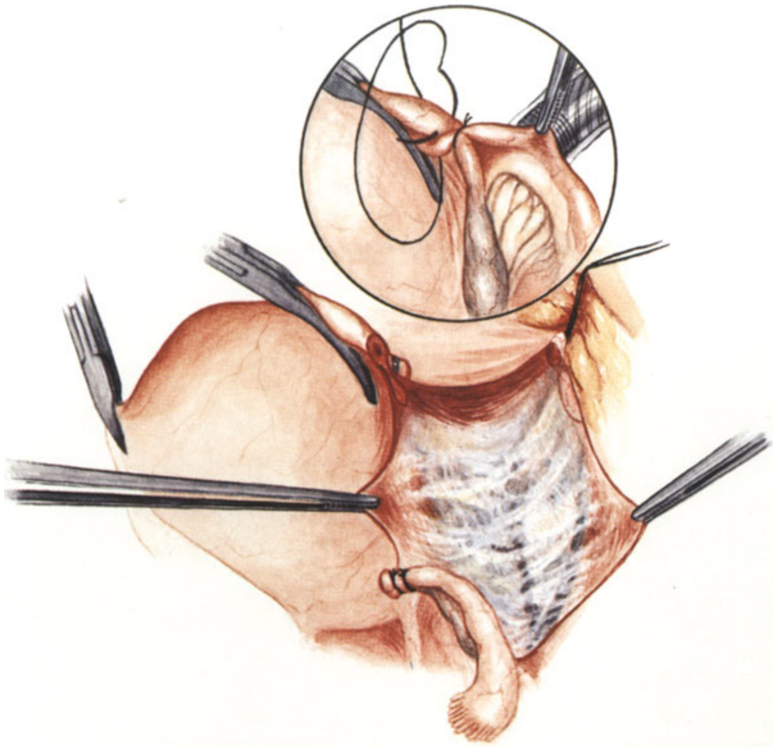


FIGURE 15-12. When the ovaries are to be left, perform the procedure as described in Fig. 15-9, with the double ligation below the tube and ovary. *Inset:* Carry the incision down alongside the Masterson clamp along the fundus. Cauterize any small peritoneal bleeders.

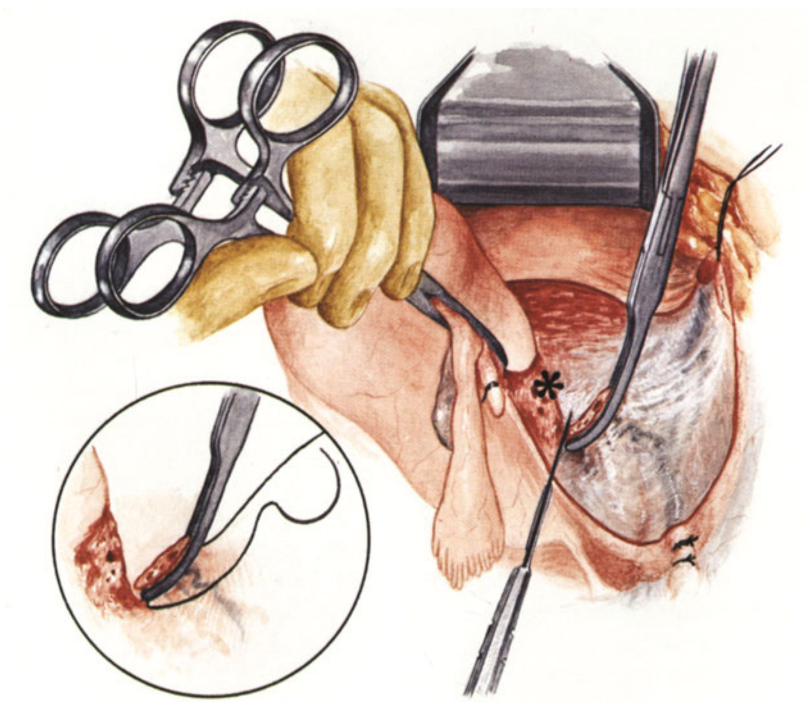


FIGURE 15-13. With strong traction to the left, the uterine arteries will be visible in the lower end of the dissection. Dissect them using long Nelson scissors and Adson-Brown forceps. Determine the position of the ureter lateral to the uterine arteries both by observation and palpation; as these structures course upward along the uterus they may be angled slightly anterior. One may observe the uterine artery arising from the obliterated hypogastric, assuming a slightly spiral course as it nears the uterus. After these vessels have been identified, place a curved Masterson clamp at the cervix uteri junction with the tip directly on the uterus. The uterine portion may be handled in a variety of ways. If the vessels are small, brief pressure or a clip will control the bleeding. *Asterisk:* If the uterus is large and vascular, straight Masterson clamps are placed in the proximal side. *Inset:* Divide the artery and place an absorbable 2–0 or 3–0 suture at the tip of the clamp with three secure square knots. Cut the sutures along the knot.

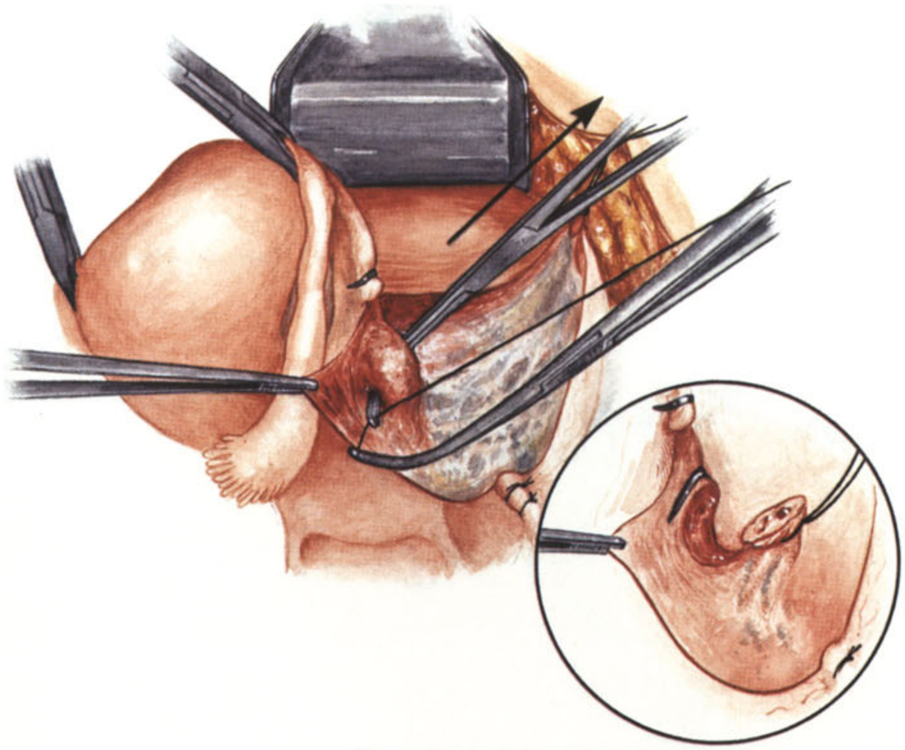


FIGURE 15-14. Another method of handling the uterine arteries when they are small and venous congestion is minimal is to place a Gemini artery forceps between the vascular bundle lying alongside the uterus. Pass a 2–0 or 3–0 absorbable suture with a similar clamp, pull through, and ligate. *Inset:* If the vessels are small, place a clip above them for better visibility; if not, use a small hemostat to secure them proximally.

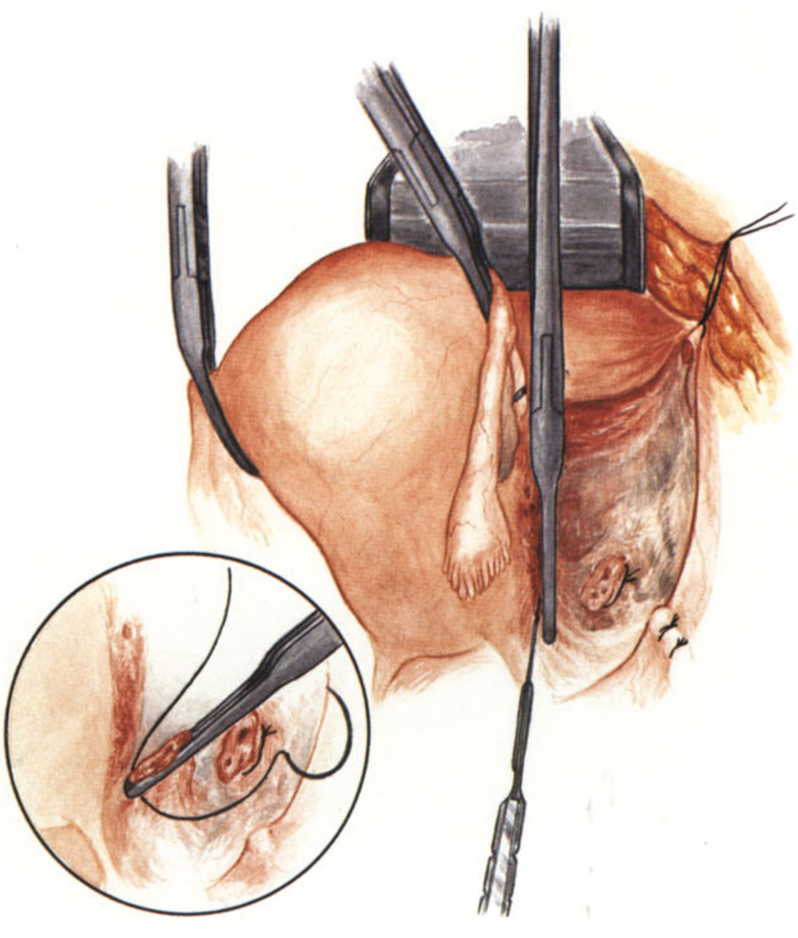


FIGURE 15-15. Once the uterine arteries are secured bilaterally, the uterine supports are seen. Vital to the remaining dissection is the adequacy of the original bladder dissection. If the bladder is well down, the white fibers of the vagina may be seen, with the upper portion of the cardinal ligaments visualized. Place straight Masterson clamps along the cervix, making a sharp division of tissues with a knife. When necessary, take two small bites of tissue and do not attempt to secure too large a portion of tissue in a clamp. Close the clamp only tightly enough to hold the tissue for suture approximation. *Inset:* Ligate the pedicle with 2–0 or 3–0 absorbable suture. Although many complex sutures have been described for use in the pelvis, a single simple tie with three square knots will hold these tissues satisfactorily.

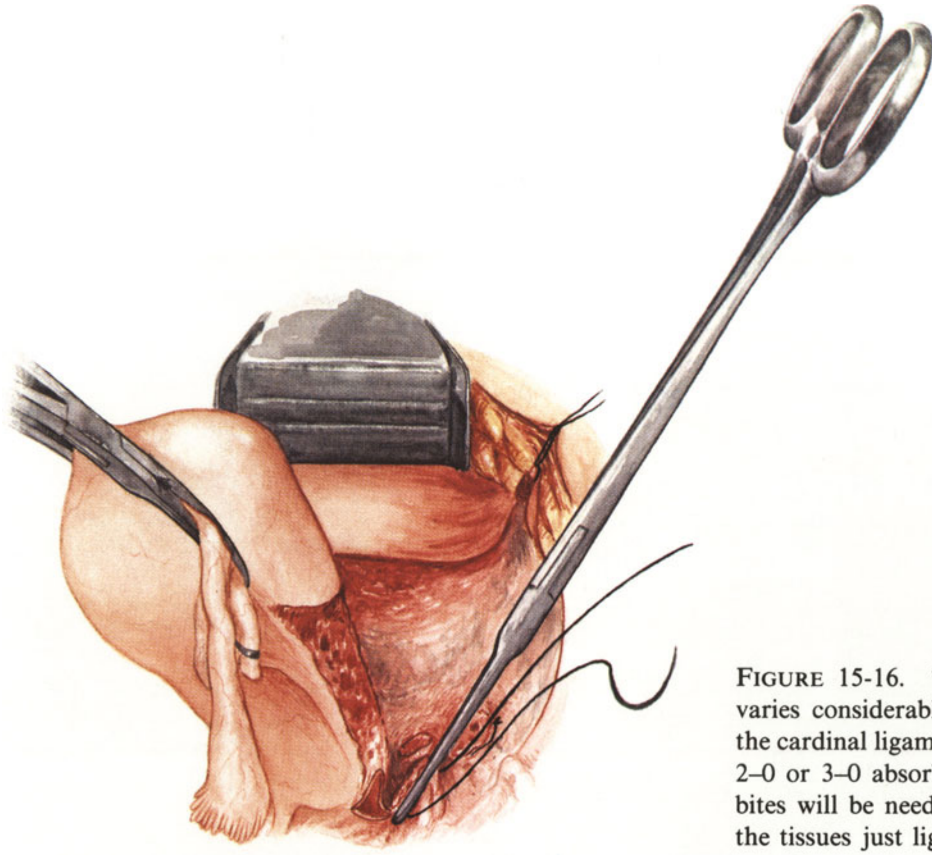


FIGURE 15-16. The anatomy of the vaginal fornix varies considerably. When small, one purchase after the cardinal ligament will enter the vagina: secure with 2–0 or 3–0 absorbable suture. In other patients, two bites will be needed. Place the next clamp medial to the tissues just ligated.

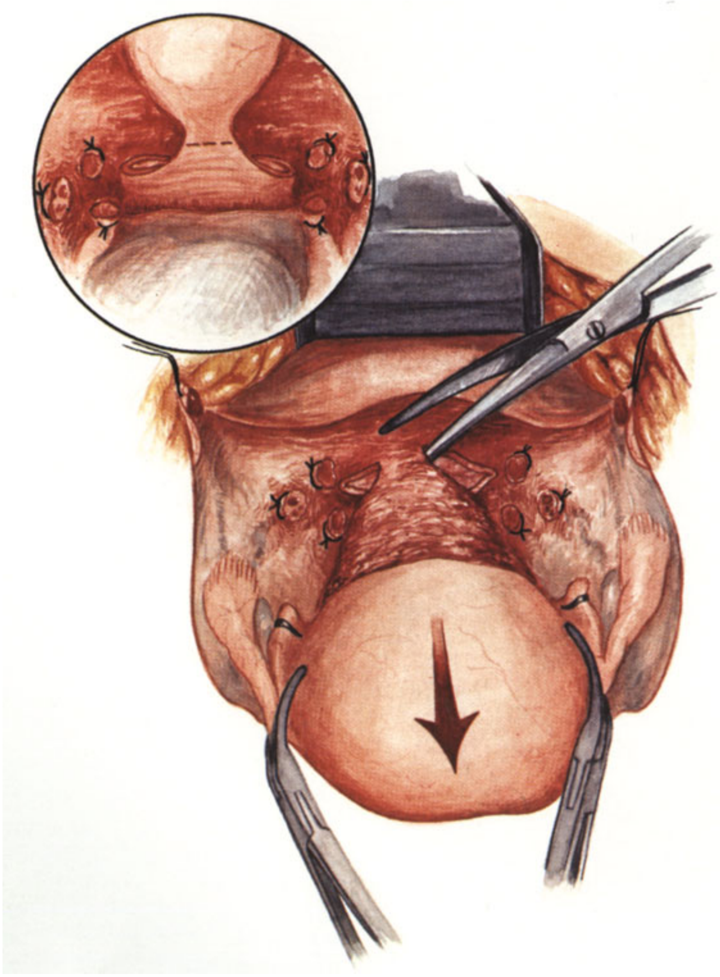


FIGURE 15-17. Following the bilateral entry into the vaginal fornix, the specimen is ready for removal. Use a knife or a heavy scissor with a blade sharply angled for this purpose. Do not use fine dissecting scissors as they will lose their preciseness in cutting heavy vaginal tissues. *Inset:* Pull the uterus upward. Note the position of the three supporting and vascular pedicles as one looks at the pelvic floor. The uterine arteries will be the uppermost pedicle, the cardinal pedicle will be directly at the angle of the vagina, and the uterosacral and posterior vagina will lie slightly posterior.

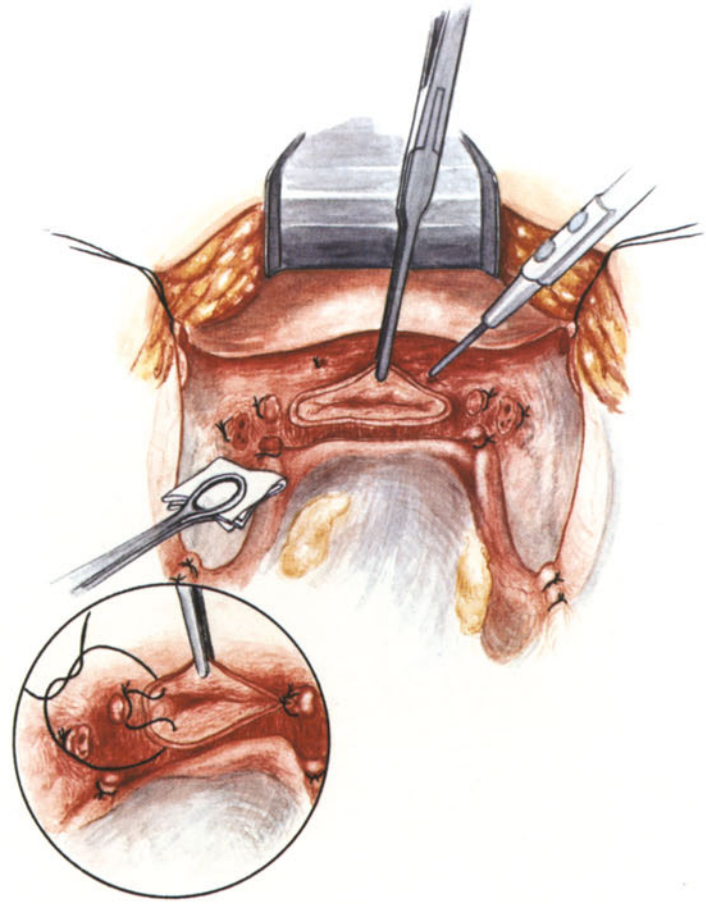


FIGURE 15-18. After removing the specimen, obtain careful hemostasis. Use the cautery on small bleeders and suture the arterial bleeders with 3–0 absorbable suture. If bleeding persists following vaginal closure, a small portion of Avitene may be placed laterally. *Inset:* After hemostasis is secured, the vagina is supported with a suture that passes from the anterior vagina through to the interior, up into the cardinal ligament, back to the interior of the vagina, and out again. Tying this suture provides adequate support for the vagina. If nearby, the uterosacral may be included, but it is not necessary. The use of taper needles will minimize the bleeding associated with passage of this particular suture.

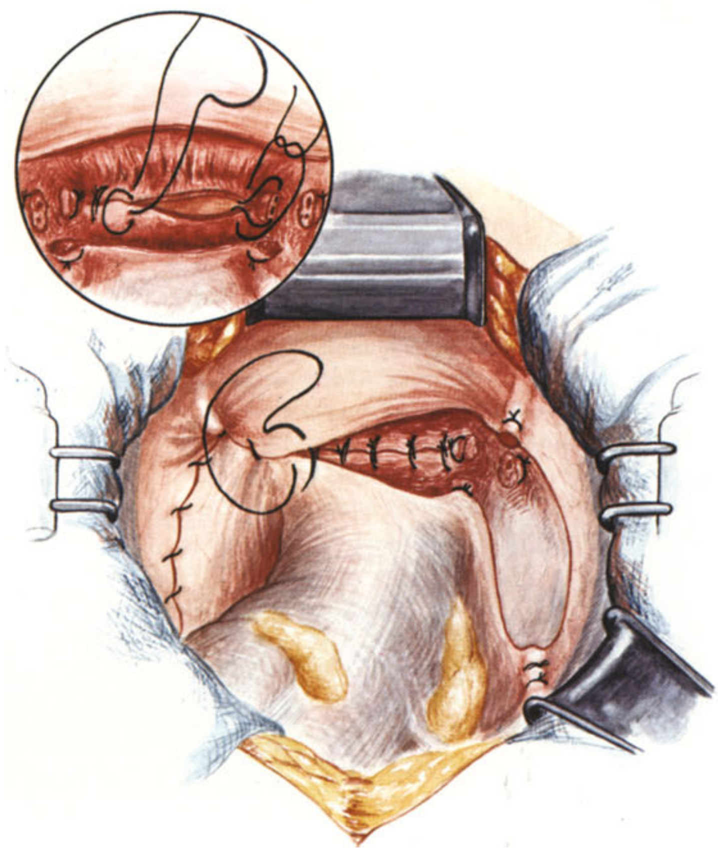


FIGURE 15-19. Suture the opposite cardinal ligament to the vagina and close the vagina by passing a 3–0 absorbable suture through the vagina approximately 6 to 8 mm from its edge; then bring the suture over, catching the margins and tying them. *Inset:* This modified far-and-near suture provides sufficient strength with small suture, obliterates dead space, and accurately approximates the epithelial margins. This prevents granulations in the vaginal cuff and provides additional vaginal strength. If the ovaries have been removed, the pelvis may then be peritonealized using a running 3–0 absorbable suture. Dead spaces should be obliterated by passing the needle through the upper part of the vagina in one or two areas. If no peritoneum is available or the quality of the peritoneal coverings are insufficient due to inflammatory changes, allow the sigmoid to cover the wound.

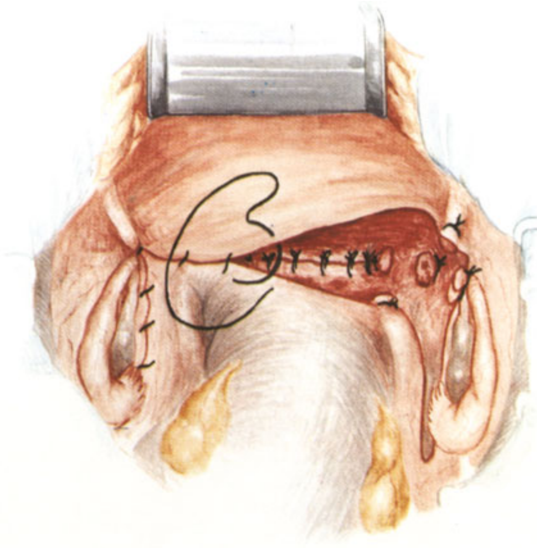


FIGURE 15-20. When the ovaries are to remain in place, take care that they are well into the intraperitoneal space, particularly the left ovary. On closing, the ovary should be sutured well up on the lateral wall to prevent it from becoming enmeshed in healing peritoneum. When this occurs, a seroma-like tumor will form, creating a subsequent need for exploration 6 months to 1 year following this procedure. Pay particular attention to the location of the ureters during closure, always visualizing them carefully when suturing next to them and using long Adson-Brown thumb forceps for peritoneal traction.

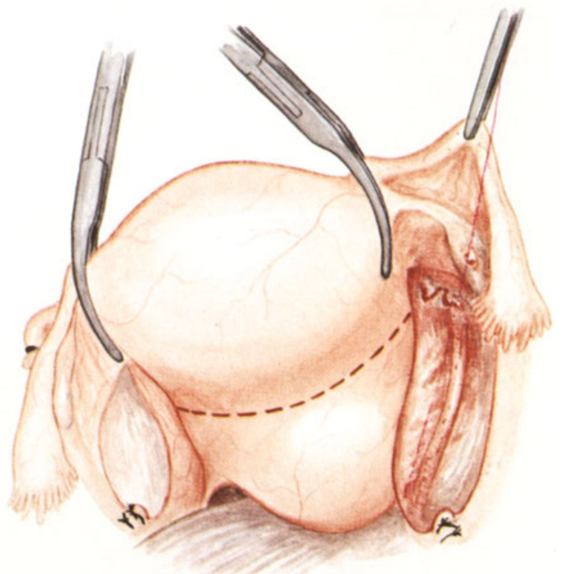


FIGURE 15-21. Identify and ligate the ovarian vessels and round ligaments as in total abdominal hysterectomy. Isolate the ureters and uterine arteries with sharp and blunt dissection. Ligate the uterine arteries under direct vision with 2–0 absorbable suture. Transect the uterus above the uterine arteries as shown by the dotted line.

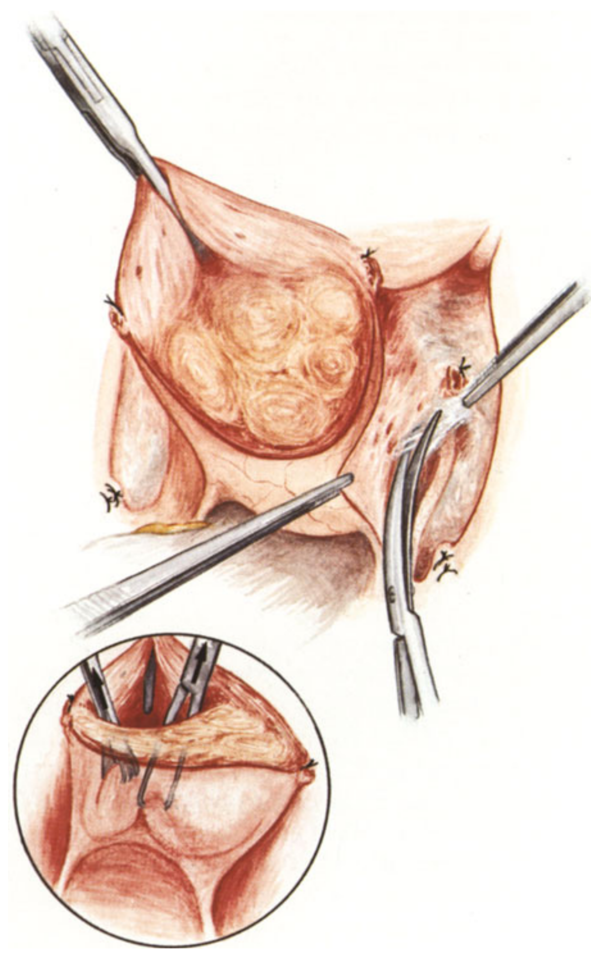


FIGURE 15-22. Pull strongly upward on the remaining cervix and the stump of the uterine artery. Free the ureter. *Inset:* Place thyroid clamps, pulling the cervix upward, and open the cervical canal. Enter the vagina and excise the remaining cervix. Secure hemostasis and close the vagina in the usual fashion.

TABLE 15-1. Classification of Endometriosis

Extent of Disease	Findings
Mild	Scattered, superficial implants on structures other than uterus, tubes, or ovaries; no scarring Rare, superficial implants on ovaries No significant adhesions
Moderate	Involvement of one or both ovaries with multiple implants or small endometriomas (<2 cm) Minimal peritubular or periovarian adhesions Scattered, scarred implants on other structures
Severe	Large ovarian endometriomas (>2 cm) Significant tubal or ovarian adhesions Tubal obstruction Obliteration of cul-de-sac, major uterosacral involvement Significant bowel or urinary tract disease

Acosta AA, Buttram VC, Besch PK, et al, as cited and adapted by Hammond et al.[16]

American Fertility Society (AFS) adopted a classification system (Table 15-2). While the former system may be easier to remember, the AFS classification system is more precise and accurate. The author recommends posting a copy of the AFS classification system in the operating room to facilitate its use.

Most patients with mild endometriosis are evaluated with the laparoscope and do not initially come to laparotomy. If the patient is young and children are desired, conservative therapy with danazol is recommended. Barbieri et al[3] report 89% of patients treated with danazol alone have symptomatic improvement; 94% were improved on repeat laparoscopy/laparotomy. Of those 56 patients desiring fertility, 19.6% (11) became pregnant after danazol therapy alone. Fifteen patients (26.8%) became pregnant after danazol therapy followed by conservative laparotomy.[3]

When the above program does not produce the desired result or more extensive endometriosis is found, conservative surgery is in order. Sharp excision of the endometriomas and implants in the cul-de-sac, bladder, and bowel are indicated.

Careful peritonealization, as well as suspension of the uterus and fixation of the tubes to the parietal peritoneum, is worthwhile. An important point is to prevent the uterus and adnexae from again becoming adherent in the cul-de-sac. Depending on the initial severity of the endometriosis, 40% to 87% of such patients may achieve pregnancy, but as many as 25% of these patients will require reoperation.[16]

While presacral neurectomy is often suggested, the author is aware of no prospective study documenting its effectiveness and does not recommend it for routine use.

Keye et al reported the use of the argon laser for the removal of endometriosis.[18] Although such work is principally experimental, it may offer new avenues of management in the future. Likewise, the use of the neodymium-yag laser for the removal of the endometrium in the treatment of menorrhagia, thereby avoiding hysterectomy, is under study at the Sinai Hospital of Detroit by Goldrath et al.[13] Lasers like the neodymium-yag or other methods of endometrial removal may have the same impact on total abdominal hysterectomy as colposcopy and carbon dioxide laser treatment have had on conization. New experimental designs and careful clinical evaluation are necessary prior to the use of these procedures in other than experimental settings.

TABLE 15-2. Classification of Endometriosis (Adapted from the American Fertility Society's Revised Classification of Endometriosis, 1985)

Patient's name ____________________

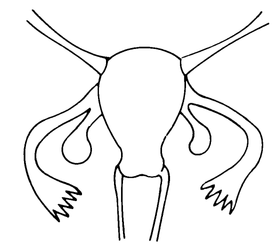
Total score ____________________

Stage ____________________

Stage I (mild)	1–5 points
Stage II (moderate)	6–15 points
Stage III (severe)	16–30 points
Stage IV (extensive)	31–54 points

Associated pathology ____________________

Means of observation ____________________



Finding	Size and Characteristics		
		PERITONEUM	
Endometriosis	<1 cm	1–3 cm	>3 cm
Score	1	2	3
Adhesions	Filmy	Dense with partial cul-de-sac obliteration	Dense with complete cul-de-sac obliteration
Score	1	2	3
		OVARY	
Endometriosis	<1 cm	1–3 cm	>3 cm or ruptured endometrioma
Score: R	2	4	6
L	2	4	6
Adesions	Filmy	Dense with partial ovarian closure	Dense with complete ovarian closure
Score: R	2	4	6
L	2	4	6
		TUBE	
Endometriosis:	<1 cm	>1 cm	Tubal occlusion
Score: R	2	4	6
L	2	4	6
Adhesions:	Filmy	Dense with tubal distortion	Dense with tubal enclosure
Score: R	2	4	6
L	2	4	6

Several studies have shown that combination of pseudopregnancy and surgery is less productive than conservative surgery alone, and postoperative progestational therapy is not beneficial.[2] The more extensive and severe forms of endometriosis generally have a low pregnancy rate. However, conservative surgery in conjunction with adjuvant measures for severe endometriosis has produced pregnancy rates of 57%[3] and 79%.[29] An initial conservative surgical procedure is warranted except in those patients with advanced disease who do not desire fertility. In such patients a total abdominal hysterectomy and bilateral salpingo-oophorectomy with the excision of implants in the bladder, cul-de-sac, and any constricting lesions of the small bowel and colon are recommended. Although there are proponents of ovarian conservation, there is an associated 10% to 12% reoperation rate.[30] It seems unwise to leave one of the most common sites of endometriosis in a patient who requires hysterectomy for control of her disease, and the author advises total abdominal hysterectomy and bilateral salpingo-oophorectomy in these patients.

Estrogen replacement therapy may be given, particularly if the patient is young, without undue risk of recurrence of disease. If symptoms such as dyspareunia recur, which is rare in the author's experience, estrogen may be stopped for a few weeks and resumed at a later date. If extensive gastrointestinal endometriosis is left in situ, begin estrogen therapy 3 weeks after surgery. Resect severe rectosigmoid endometriosis as well as extensive endometriomas of the small bowel and bladder if they compromise the lumen or deeply invade these structures.

Finally, the presence of cul-de-sac nodules in a fixed ovarian mass in a young patient, while very suggestive of endometriosis, is not an indication for a therapeutic trial of progestational agents. A 20-year-old female presented on the author's service with these findings but her underlying disease process was that of a stage III serous cystadenocarcinoma of the ovary. Such patients should have laparoscopic documentation and laparotomy as indicated.

As endometriosis often involves the cul-de-sac and uterosacral ligaments and destroys the intraperitoneal planes by fixation of large endometriomas into the cul-de-sac, the usual surgical planes are often lost; therefore, approach these lesions in a peripheral fashion, working in the extraperitoneal spaces. Trace the ureters downward after ligating the ovarian blood supply. As soon as the ureters are dissected well into the pelvis, mobilize the ovarian masses medially and free the uterus upward. Stay extremely close to the uterus in this particular disease process as the ureters do not mobilize in the usual fashion because the uterosacral ligaments and the areas near the ureters are often primarily involved with this disease. As the posterior peritoneum and cul-de-sac may be completely obliterated with endometriosis, enter the vaginal vault anteriorly in the midline. Pull the vault upward with traction on two Masterson clamps near the cervix after dissecting the bladder downward. Enter the vault in the midline with a knife and carry the dissection laterally close to the uterus. Place the thumb in the vault and direct the index finger toward the adherent colon, making posterior dissection of the uterus much safer. Grasp the vault with Masterson clamps, pull upward, and suture. Place 3–0 absorbable suture near the vaginal margins as mobilization of the bladder and ureters is often quite limited. Do not worry about vaginal cuff suspension in patients with severe endometriosis as marked fibrosis makes prolapse uncommon. If there is marked destruction of the pelvic peritoneum and the sigmoid fails to cover the defect, fashion an omental carpet by bringing the omentum along the left side of the pelvis.

Depending on how carefully one looks, endometriosis of the bowel may be found in 15% to 50% of patients. Gray reported 179 cases of endometriosis of the bowel occurring in 1,500 patients operated on for endometriosis: 81 patients had simple excision of the endometriosis, 61 patients had incomplete excision, and 37 patients had bowel resection for extensive lesions with either end-to-end anastomosis (10 cases) or excision of the full thickness of the anterior bowel wall (27 cases).[14] Of the 81 patients who had surface excision of the bowel, 79 received estrogens postoperatively, and approximately 20% developed some recurrent symptoms that were relieved by cessation of estrogens. Note that in none of these cases was the mucosa of the gut perforated and proctosigmoidoscopy always revealed a normal mucosa. Although some bowel lesions responded to castration, those patients with marked intestinal symptoms and severe lesions required excision of the bowel endometriosis, and this was the preferred approach in this group of patients. Colostomy was rarely necessary. Pratt in discussing Gray's paper recommended bowel resection if endometriosis diminishes the lumen of the gut to 50% of its size or if the lesion completely surrounds the bowel. Furthermore, if the patient is young, her need for estrogens or the possibility of conservative surgery would point toward resection in these patients.[14]

Leiomyoma

Prior to hysterectomy obtain a suction biopsy of the endometrial cavity or perform gross examination of curettings with frozen section where indicated.

Often the surgery of large leiomyomas is limited by their size. Once the ovarian vessels have been ligated, exposure can be gained by excision of the larger leiomyomas and suturing of their base. Hysterectomy can then proceed in a more orderly fashion. It is absolutely vital that the surgeon be certain that there is no malignancy in the uterus in the course of such maneuvers, as operating through an area of cancer would prove disastrous for the patient.

Cervical leiomyomas can pose a difficult problem in pelvic surgery, particularly if the lesion has been allowed to expand and trap itself inside the pelvis. The ability to mobilize such lesions may be severely limited and exposure may be greatly compromised. Very careful examination under anesthesia preceding the operation is helpful in delineating the lesion. Although ureteral catheters are often advised in such patients, if the lesion is really large the trigone will be so distorted that insertion of ureteral catheters will be quite difficult. Abdominal insertion of a plain or illuminated ureteral catheter through a longitudinal incision in the ureter is an alternative route in these patients (Figs. 15-21 and 15-22).

Pelvic Inflammatory Disease

Large pelvic abscesses and pelvic inflammatory disease greatly complicate uterine removal, but the uterus should be removed with the diseased adnexae almost without exception. It is most useful to remove the abscesses first, if possible, and then proceed to hysterectomy. The abscesses are most easily removed by entering the retroperitoneal space, mobilizing the abscesses medially, identifying the ureters, and dividing the ovarian vessels from above, sharply dissecting the lesions off the ureters under direct vision. Avoid blunt mobilization of these abscesses as clamping of their blood supply with large clamps is an invitation to ureteral injury. The ovarian vessels and blood supply to these abscesses should not be divided until the ureter has been carefully identified visually coursing below and lateral to the inferior portion of these abscesses.

Stress Incontinence Surgery

The removal of the uterus with urethral suspension has been shown to improve long-term incontinence cure rates.[15] It produces no difficulties nor compromise of the blood supply to the bladder. The retropubic space is not usually entered until the peritoneal cavity is closed, although no increase in morbidity has been noted in performing the procedures jointly.

A cystocele may be repaired through the transabdominal approach (Fig. 15-23).

Associated Vaginectomy

Colposcopy has replaced the use of routine vaginal cuff resection with hysterectomy in carcinoma in situ. Occasionally, however, the colposcope reveals that the lesion extends onto the vaginal cuff and partial vaginectomy is performed

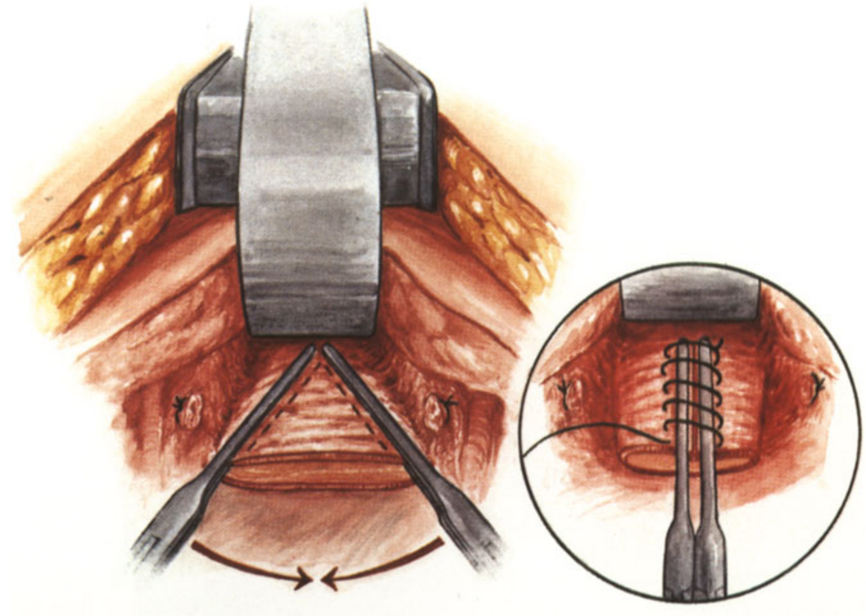


FIGURE 15-23. Transabdominal repair of cystocele is performed by dissecting the bladder further off the anterior vaginal wall in the same plane as in abdominal hysterectomy. Place two Masterson clamps downward at the apex of the dissection of the bladder and angle them toward the cardinal ligaments, forming an inverted "V." This is continued from the same plane in which the bladder was dissected off for abdominal hysterectomy. An additional 2 cm will suffice. Excise the vagina in one layer. Bring the clamps to the midline and tie a suture of 2–0 absorbable at the apex and place the suture loosely in an over-and-over fashion. Open the clamps and remove them; pull the suture up snugly. A final pass is made through the tissues and the suture is knotted. Close the vagina in the usual transverse fashion after hysterectomy with far-and-near type suture. The use of nontraumatic clamps greatly facilitates this operation and minimizes tissue reaction. Take care to place the distal suture beyond the tip of the V so as to occlude any small arteries that retract. Manage the patient as in any cystocele repair.

with hysterectomy (Fig. 15-24). Note the lack of correlation of intraepithelial neoplasia and Schiller's test; do not use this test for guidance on the limits of excision.[27]

Adenocarcinoma of the Endometrium

The author believes that it is important not to unduly manipulate adenocarcinoma of the endometrium owing to the demonstration of increased numbers of cells in the draining venous blood in the manipulated cancer. The piston effect of a dilator also should be remembered. This can force the tumor out into lymphatic and venous systems as does hysteroscopy and hysterosalpingography. Preoperative evaluation by suction biopsy and the intraoperative avoidance of forceful examination under anesthesia minimize the risk of tumor spread. Also, do not place a tenaculum on the fundus in endometrial cancer. Hemisection for exposure or subtotal excision of the uterus is also unacceptable. In the standard recommended technique the blood supply to the upper uterus is immediately clamped. The ovarian vessels are tied, and dissection proceeds with ligation of the uterine blood supply. Long et al recommended the use of a vaginal occlusive clamp and washing of the vagina with a dilute solution of vaginal formalin or other intravaginal cytotoxic agent,[20] and some recom-

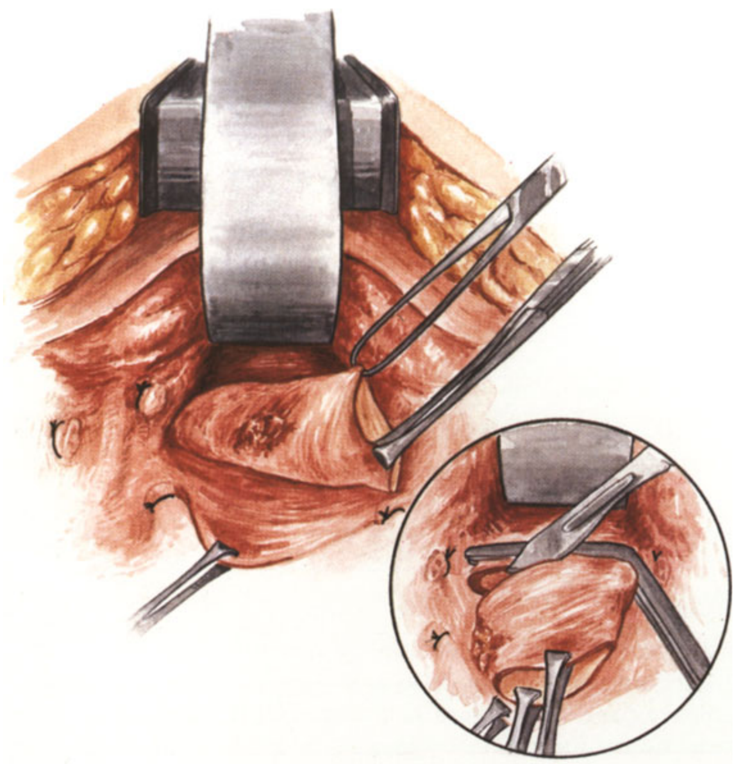


FIGURE 15-24. Vaginectomy may be needed when carcinoma in situ extends into the vagina. Mark the margins of the lesion with a colposcope prior to surgery. Mark the distal end with Allis clamps fixed to the vagina that can be easily felt, thereby obtaining an accurate excisional margin. Once the hysterectomy is carried downward to the stage of the cardinal ligaments, with strong upper traction and using straight Masterson clamps, take small bites of tissue, remaining close along the vagina with the bladder and ureters retracted laterally with narrow Deaver retractors. Once the desired length of the vagina to be resected is obtained and the margin is verified by feeling the Allis clamps through the vagina, make a sharp incision into the vagina and excise the specimen. Secure the margins of the vagina and close the vagina in the usual fashion. It may not be possible to approximate the cardinal ligaments when significant vagina is excised, but little difficulty usually arises. Should the patient wish vaginal function and a significant portion of the vagina is excised, use a skin graft. Place it immediately if the area is well vascularized or pull the peritoneum down to bridge the upper defect.

mend an intravaginal plug or suturing of the cervix. These latter methods, however, have not found wide use and seem not to affect the recurrence rate. In the intraoperative evaluation of the spread of adenocarcinoma of the endometrium, the surgeon would be well advised to closely evaluate pelvic and aortic nodes in view of the findings of Creasman et al[9] concerning metastatic lymph node potential (Table 15-3).

A classification of endometrial carcinoma is presented in Table 15-4. The author has abandoned routine radiation therapy and uses the indications in Table 15-5 as adopted from the outstanding contribution of Morrow, Creasman, and DeSaia. Some gynecologic surgeons continue to radiate all endometrial cancers. The efficacy of such therapy is hard to document. Piver et al recently reported no significant difference in 5-year survival rates among patients undergoing hysterectomy alone, hysterectomy plus postoperative vaginal radium, and preoperative uterine radium followed by hysterectomy for stage I, grade I endometrial cancer.[23] Morrow outlines those instances in which surgery should precede radiation (Table 15-5).

TABLE 15-3. Influence of Histologic Grade and Myometrial Invasion on Incidence of Pelvic and Aortic Node Metastases

	Pelvic Node Metastases (%)	Aortic Node Metastases (%)
Histologic Grade		
1	3.1	1.5
2	10.1	4.0
3	36.0	28.0
Depth of Invasion		
Endometrium	3.6	1.8
Inner third	11.5	9.8
Middle third	10.0	0.0
Outer third	42.9	21.4

Adapted from Creasman WT, et al.[9]

TABLE 15-4. Classification of Endometrial Carcinoma (International Federation of Gynecologists and Obstetricians, 1976)

Stage		Characteristics
0		Carcinoma in situ; histologic findings suspicious of malignancy (cases in stage 0 should not be included in any therapeutic statistics)
I		Carcinoma confined to the corpus, including the isthmus
	a	Length of uterine cavity is 8 cm or less
	b	Length of uterine cavity is over 8 cm
	Stage I cases should be subgrouped with regard to the histologic type of the adenocarcinoma as follows:	
	G1	Highly differentiated adenomatous carcinoma
	G2	Differentiated adenomatous carcinoma with partly solid areas
	G3	Predominantly solid or entirely undifferentiated carcinoma
II		Carcinoma has involved the corpus and the cervix, but has not extended outside the uterus
III		Carcinoma has extended outside the uterus, but not outside the true pelvis
IV		Carcinoma has extended outside the true pelvis or has obviously involved the mucosa of the bladder or rectum; bullous edema, as such, does not permit a case to be allotted to stage IV
	a	Spread of the growth to adjacent organs
	b	Spread to distant organs

TABLE 15-5. Indications for Surgery Prior to Radiation Therapy in Patients with Operable Endometrial Carcinoma

Stage I, grade 1 tumors
Clinical or laboratory evidence of suspected extrauterine spread
Pyometra
Previous adnexal or pelvic abscess
Adnexal or abdominal mass
Prior pelvic irradiation
Diverticulitis
Ascites

Adapted from Morrow CP, Schlaerth JB: Surgical Management of Endometrial Carcinoma. *Clin Obstet Gynecol* 1982; 25:81–92.

The most inaccurate clinical staging in gynecology is that of stage II endometrial cancer. Because of this, the author prefers to operate on all patients with stage II endometrial cancer except for those with obvious gross invasion of the cervix. Patients with a normal cervix on gross examination and a positive fractional curettage frequently have no disease in the specimen upon pathologic examination. The author's experience has yielded an unusual number of false positive diagnoses and therefore significant overtreatment of endometrial cancer. The association of radiation therapy and surgical procedures in the treatment of stages I and II endometrial cancers and stages III and IV is summarized in Tables 15-6 and 15-7, respectively. In endometrial cancer as well as in cervical cancer careful planning and coordination of radiation therapy and associated surgical procedures will produce a result far superior to that achieved by an ill-conceived excision preceding proper planning.

Uterine sarcomas, while comprising only 1% to 3% of uterine cancers, deserve a brief comment. Diagnosis requires astute histopathology. Many of the tumors diagnosed clinically as "low grade" sarcomas are, upon pathologic examination, benign. Much of the data in the literature on sarcomas include those benign tumors. This tends to falsely deflate the mortality rate. When those incorrectly diagnosed "low grade" sarcomas are deleted from the data, the true mortality rate from sarcomas becomes significant. Five-year cure rates are at best 25% in most series. Although adjuvant radiation therapy

TABLE 15-6. Management of Stages I and II (Occult) Endometrial Carcinoma

Exploratory laparotomy
Peritoneal cytology
Evaluation of liver, omentum, and extraperitoneal nodes
Total abdominal hysterectomy and bilateral salpingo-oophorectomy
Progesterone and estrogen receptor assay, when advisable
Add pelvic irradiation:
1. Grades 1 and 2 lesions with >⅓ myometrium involvement
2. Grade 3 lesions
3. All cases with vascular invasion, adenexal or pelvic node metastases
4. All cases extending to lower third of corpus, isthmus, or cervix
5. All cases with pelvic node metastases

Add aortic irradiation where pelvic nodes have a positive biopsy

Adapted from Morrow CP, Schlaerth JB: Surgical Management of Endometrial Carcinoma. *Clin Obstet Gynecol* 1982; 25:81–92.

TABLE 15-7. Management of Stages III and IV Endometrial Cancer

Stage III
- Determine extent of disease
  - Use fine needle biopsy where possible
  - Evaluate liver and lungs
  - Exploratory laparotomy
- Pelvic Irradiation
- Hysterectomy and bilateral salpingo-oophorectomy if response to irradiation has decreased tumor bulk sufficiently to permit surgery

Stage IV
- Individualized irradiation therapy
- Chemotherapy
- Surgery
- Operate for fistula as needed

Adapted from Morrow CP, Schlaerth JB: Surgical Management of Endometrial Carcinoma. *Clin Obstet Gynecol* 1982; 25:81–92.

appears to increase tumor control in the pelvis, it does not appear to influence 5-year survival rates.[28] Salazar et al found that 90% of the patients whose treatment failed had metastases outside the pelvis. The use of chemotherapy, while encouraging because of the reduction in pulmonary metastases, has not produced significant long-term cure rates. When the sarcoma has spread beyond the uterus, current clinical data predict a bleak outcome.

If an incidental appendectomy is planned, use the simple purse-string suture technique and cross-clamping of the appendix as described in Chapter 23.

Following the appendectomy, remove the pack from the pelvis; ligate small bleeding points or use the cautery. If the procedure is performed for malignant disease, hemostatic clips are most helpful in outlining any residual disease.

Wound Healing

Wound healing studies indicate that the peritoneum regenerates relatively quickly. No attempt at peritonealization is necessary and probably fewer adhesions will result than if meticulous attempts at peritonealization are undertaken. If, however, peritonealization is desired, approximate the visceral peritoneal margins with 3–0 absorbable suture. Take note of the precise position of the ureters on the proximal peritoneal surface. Do not place sutures proximal to the doubly ligated ovarian vessels as hematoma will result, with large extraperitoneal collections of blood in some patients. If, at this time, any hematoma is noted in the ovarian vessels, carefully isolate the vessels, dissect upward, and doubly ligate in the technique described and excise the distal hematoma.

If the hysterectomy was performed for endometriosis or pelvic inflammatory disease and the peritoneal surface has already been greatly compromised, little normal pelvic peritoneum may remain. If both ovaries have been removed, the sigmoid may be allowed to fall into the pelvis and the omentum may be pulled downward. If the left ovary is left in place, however, a retrosigmoid tumor may form, which appears grossly like a simple serous cystadenoma. Serosal surface forms about the ovary and, if continued ovulation occurs, a retrosigmoid mass of some proportion may result, requiring later laparotomy. If the ovaries are to be left in, they should be pulled well up out of the pelvis and, if on a long ovarian vascular pedicle, they should be sutured to the lateral pelvic wall peritoneum. The sigmoid may be used, freely sutured directly to the bladder flap as needed, as bowel obstruction from adhesions to the sigmoid colon is remarkably rare.

Should drainage be necessary, the author prefers suction drainage of the Hemovac type. Place the catheters by inserting the trocar through the abdominal wall, taking care to palpate the inferior epigastric vessels, and inserting the trocar into the retroperitoneal space behind the round ligaments. The catheter is directed downward to the contralateral retroperitoneal operative field and is left in until the drainage does not exceed 30 mL/24 hr. There is little rationale for the use of Penrose drains through the vagina or through stab wounds throughout the lower abdomen, as they produce very little drainage and increase the bacterial access.[22] Suction catheters are inert; they are associated with very few complications and produce adequate suction to extract serum, blood, or any other materials that accumulate. The author does not favor the use of a T-tube type drain after abdominal hysterectomy as the drain is in the area of the vaginal cuff, an area that is subjected to the most trauma during abdominal hysterectomy; the drain provides a site of access to traumatized tissues containing abundant amounts of suture material, which, experimentally, greatly increases the incidence of wound infections.[22]

Although antibiotic prophylaxis is clearly effective in vaginal hysterectomy, the current data do not support an unconditional recommendation for prophylactic antibiotic use in abdominal hysterectomy. Duff's study indicates prophylactic antibiotics produce no significant difference in incidence of pelvic cellulitis, urinary tract infection, wound infection, the need for therapeutic antibiotics, or length of hospitalization.[11]

Postoperative Management

Meticulous care in the recovery area and during the subsequent postoperative period is important. The surgeon must be aware of the tendency among anesthesiologists to over-infuse fluids relative to their loss and must, therefore, compensate for any over-infusion received in the operating room. The patient will require intravenous fluids for the first 24 hours; 5% dextrose and water is a suitable intravenous infusion. The dosage should rarely exceed 3,000 mL/day. The author almost never uses indwelling nasogastric suction, and it is rarely needed in abdominal hysterectomy. If, however, the patient should have nasogastric suction for some other reason, then one-half normal saline with a potassium supplement would provide an adequate amount of chloride and avoid any tendency toward alkalosis. Patients are encouraged to ambulate as soon as possible, and the Foley catheter should be removed as soon as the patient is capable of voiding. Encouraging the patient to cough is the most effective postoperative procedure to avoid atelectasis; the author does not routinely use positive pressure breathing. A small disposable plastic respirator may be used to encourage increased respiratory volume. Obtain routine blood gases during surgery, and in patients with compromised cardiopulmonary symptoms, obtain blood gases in the recovery room. Give the patient a Fleets enema on the second postoperative day and order a diet as tolerated when the patient passes flatus. Check the hemoglobin and hematocrit on the second postoperative day. They should not differ greatly from the preoperative levels in the average patient.

Remove skin sutures, clips, or staples on the sixth or seventh postoperative day. Monofilament nylon suture properly placed will produce minimal skin reaction. In a transverse incision with absorbable subcuticular skin closure, the ends of the suture may be cut the evening before discharge.

One day prior to discharge prescribe estrogen replacement for the patient in whom the uterus was removed for benign disease. In patients who had significant intraoperative bleeding, prescribe an iron preparation. Although the patient's hemoglobin level may be within the normal range, iron stores may have been depleted.

The author recommends that a surgical associate, who may be a nurse clinician, have a prolonged uninterrupted visit with the patient prior to discharge to instruct her in postoperative care, diet, and level of activity. In addition, the patient is provided with printed instructions and a return appointment in 2 weeks. The author also provides the patient with a copy of the pathology report for her retention.

Postoperative Complications

Dicker et al reviewed in detail the complications of abdominal and vaginal hysterectomy occurring in a series of women of reproductive age. This study is summarized in Table 15-8. Fully 42.8% of the women undergoing abdominal hysterectomy experience one or more complications.[10]

This high morbidity rate, however, is not inherent in the procedure of

TABLE 15-8. Complication Rates* Among Women Aged 15 to 44 Undergoing Hysterectomy, by Surgical Approach, Collaborative Review of Sterilization (CREST), 1978 to 1981

Complication	Complication Rate* Vaginal (n = 568)		Abdominal (n = 1,283)	
Febrile morbidity:	15.3		32.3	
Source unidentified		7.2		16.8
Urinary tract infection		3.4		7.0
Abdominal incision infection		0		5.0
Vaginal cuff infection		2.1		3.1
Pelvic infection		1.2		1.3
Upper respiratory tract infection		0.9		0.4
Pneumonia		0.4		0.4
Sepsis		0.4		0.2
Peritonitis		0.2		0
Other		0.4		0.5
Hemorrhage requiring transfusion:	8.3		15.4	
Intraoperative transfusion		4.9		10.0
Postoperative transfusion		3.4		5.4
Unintended major surgical procedure:	5.1		1.7	
Intraoperative				
To complete hysterectomy		1.1		0
To repair bowel trauma		0.4		0.3
To repair bladder trauma		1.4		0.3
To control bleeding†		0.7		0.2
Postoperative				
To repair ureter trauma‡		0		0.2
To repair bowel trauma‡		0.2		0
To repair bladder trauma‡		0.2		0
To control bleeding†‡ or evacuate hematoma		1.2		0.3
Other		0		0.3
Life-threatening event:	0		0.4	
Pulmonary embolus/infarct		0		0.2
Myocardial infarction, cardiac and/or pulmonary arrest		0		0.1
Anaphylactic reaction		0		0.1
Disseminated intravascular coagulation		0		0.1
Rehospitalization:	1.8(n = 536)		2.8(n = 1,232)	
Bleeding		0.7		1.1
Infection		0.7		0.6
Pulmonary embolus		0		0.3
Other		0.4		0.7
Death	0.2		0.1	
One or more complications	24.5		42.8	

* Rate per 100 women undergoing hysterectomy.
† Other than that attributable to bowel, ureter, or bladder trauma.
‡ Not noted intraoperatively.
Adapted from Dicker et al.[10]

abdominal hysterectomy. Richardson studied various techniques employed in abdominal hysterectomy over a period of years during his service in the Crawford W. Long Hospital. His initial series of patients were operated on with Heaney clamps, self-retaining retractors, and a chromic suture. Richardson noted a febrile morbidity of 22% in these patients and a transfusion rate of 48%. When Richardson and co-workers altered their technique to a much less traumatic one with fine suture and nontraumatic handling of tissues, the febrile morbidity rate fell to 2.4% and the incidence of transfusions fell to 3.5%.[26]

The author has observed a similar variability in morbidity, transfusion, and complication rates in gynecologic surgery based primarily on the handling of tissues and techniques and suture material used. There is little justification today for the occasional operator or the untrained surgeon performing with great difficulty, excessive blood loss, and complication-ridden postoperative course for a procedure that may be performed simply, in a brief period of time, with a short hospital stay by a more experienced and skillful surgeon using more modern suture materials, instruments, and techniques. Careful review of complications in pelvic surgery will define those parameters useful in minimizing the complications of this abdominal procedure.

The mortality rate for abdominal hysterectomy is 0.1%[10] to 0.2%[19]; although modern techniques permit performance of hysterectomy without great consideration for mortality, note that 10 to 20 women die for every 10,000 hysterectomies performed. The evidence is that thrombosis is an important source of morbidity and mortality in gynecologic surgery. Bernstein et al noted a 17% incidence of deep venous thrombosis in 276 patients when evaluated by ^{125}I-fibrinogen uptake test.[4] Thirty-six percent of the patients who had abdominal hysterectomy for malignant disease had deep venous thrombosis, signaling the very high incidence in gynecologic surgical cancer patients. This occurred despite the fact that patients had early ambulation and some had received dextran prophylactically. A significantly higher incidence of thrombosis was noted in patients who received preoperative estrogen. Thirty-nine percent developed deep venous thrombosis compared with only 27% of patients without preoperative estrogen treatment. Three patients showed evidence of pulmonary embolism but none of the patients died.

In a 10-year review of 6,435 hysterectomies performed at Hutzel Hospital in Detroit, 17 patients died. Of these, five died of pulmonary embolism.[1] Three patients died of subarachnoid hemorrhage, and four patients died of sepsis and/or peritonitis. Two patients with disseminated carcinoma died of cardiac failure and pulmonary edema. The importance of Bernstein's findings that 17% of abdominal hysterectomies evidenced deep venous thrombosis is even more significant when one reviews the cause of death in this large series. One can do little about patients with inoperable cancer or those with developing subarachnoid hemorrhage, but the most common single cause of death in this series was pulmonary embolism. Many authors have studied methods of decreasing pulmonary embolism, but there is no clear-cut evidence that any method currently employed will prevent deep venous thrombosis or pulmonary embolism. Standard treatment includes support stockings, early ambulation, passive resistance, and selective heparin utilization. The most common doses are 5,000 to 10,000 IU for 12 hours, depending on body weight. Both the patient and the surgeon should consider the benefits to be derived from surgery and weigh the risk, though slight, of the patient's dying.

References

1. Amirikia H, Evans TN: Ten-year review of hysterectomies: Trends, indications, risks. *Am J Obstet Gynecol* 1979; 134:431–437.
2. Andrews WC, Larsen DC: Endometriosis: Treatment with hormonal pseudopregnancy and/or operation. *Am J Obstet Gynecol* 1974; 118:643–651.
3. Barbieri RL, Evans S, Kistner RW: Danazol in the treatment of endometriosis: Analysis of 100 cases with a 4-year follow-up. *Fertil Steril* 1982; 37:737–746.
4. Bernstein K, Ulmsten U, Astedt B, et al: Incidence of thrombosis after gynecologic

surgery evaluated by an improved ^{125}I-Fibrinogen uptake test. *Angiology* 1980; 31:606–613.
5. Blaustein A: *Pathology of the Female Genital Tract.* New York, Springer-Verlag, 1977.
6. Carter B: Treatment of endometriosis. *J Obstet Gynaecol Br Comm* 1962; 69:783–789.
7. Christopherson WM, Gray LA, Parker JE: Microinvasive carcinoma of the uterine cervix: long term follow up study of 80 cases. *Cancer* 1976; 38:629–632.
8. Chung AF, Menon J, Dillon TF: Acute postoperative retroperitoneal fibrosis and ureteral obstruction secondary to the use of Avitene. *Am J Obstet Gynecol* 1978; 132:908–909.
9. Creasman WT, Boronow RC, Morrow CP, et al: Adenocarcinoma of the endometrium: Its metastatic lymph node potential. *Gynecol Oncol* 1976; 4:239–243.
10. Dicker RC, Greenspan JR, Strauss LT, et al: Complications of abdominal and vaginal hysterectomy among women of reproductive age in the United States. *Am J Obstet Gynecol* 1982; 144:841–848.
11. Duff P: Antibiotic prophylaxis for abdominal hysterectomy. *Obstet Gynecol* 1982; 60:25–29.
12. Esterday CL, Grimes DA, Riggs JA: Hysterectomy in the United States. *Obstet Gynecol* 1983; 62:203–212.
13. Goldrath MH, Fuller TA, Segal S: Laser photovaporization of endometrium for the treatment of menorrhagia. *Am J Obstet Gynecol* 1981; 140:14–19.
14. Gray LA: Endometriosis of the bowel: Role of bowel resection, superficial excision and oophorectomy in treatment. *Ann Surg* 1973; 177:580–587.
15. Green TH: Urinary stress incontinence: Differential diagnosis, pathophysiology, and management. *Am J Obstet Gynecol* 1975; 122:368–400.
16. Hammond CB, Rock JA, Parker RT: Conservative treatment of endometriosis: The effects of limited surgery and hormonal pseudopregnancy. *Fertil Steril* 1976; 27:756–766.
17. Ingersoll FM, Malone LJ: Myomectomy: An alternative to hysterectomy. *Arch Surg* 1970; 100:557–561.
18. Keye WR Jr, Matson GA, Dixon J: The use of the argon laser in the treatment of experimental endometriosis. *Fertil Steril* 1983; 39:26–29.
19. Ledger WJ, Child MA: The hospital care of patients undergoing hysterectomy: An analysis of 12,026 patients from the Professional Study Activity. *Am J Obstet Gynecol* 1973; 117:423–433.
20. Long RT, Sala JM, Spratt JS: Endometrial carcinoma recurring after hysterectomy: A study of 64 cases, with observations on effective treatment modalities and implications for alteration of primary therapy. *Am J Obstet Gynecol* 1978; 29:318–321.
21. Magrina JF, Masterson BJ, Cameron WJ, et al: Study of the effects of topical hemostatic agents on the retroperitoneum and ureters of dogs. *Arch Gynecol* 1982; 231:135–140.
22. Peacock EE, Van Winkle W: *Wound Repair.* Philadelphia, Saunders, 1976.
23. Piver MS, Yazigi R, Blumenson L, et al: A prospective trial comparing hysterectomy, hysterectomy plus vaginal radium, and uterine radium plus hysterectomy in stage I endometrial carcinoma. *Obstet Gynecol* 1979; 54:85–89.
24. Ranney B, Frederick I: The occasional need for myomectomy. *Obstet Gynecol* 1979; 53:437–441.
25. Rao PS, Cavanagh D, Richman AV, et al: An evaluation of the tendency of Avitene to produce periureteral fibrosis in the dog. *Am J Obstet Gynecol* 1983; 145:87–91.
26. Richardson AC, Lyon JB, Graham EE: Abdominal hysterectomy: Relationship between morbidity and surgical technique. *Am J Obstet Gynecol* 1973; 115:953–961.
27. Rubio CA, Thomassen P: A critical evaluation of the Schiller test in patients before conization. *Am J Obstet Gynecol* 1976; 125:96–99.
28. Salazar OM, Bonfiglio TA, Patten SF, et al: Uterine sarcomas: Analysis of failures

with special emphasis on the use of adjuvant radiation therapy. *Cancer* 1978; 42:1161–1170.

29. Wheeler JM, Malinak LR: Postoperative danazol therapy in infertility patients with severe endometriosis. *Fertil Steril* 1981; 36:460–463.
30. Williams TJ: The role of surgery in the management of endometriosis. *Mayo Clin Proc* 1975; 50:198–203.

Radical Hysterectomy

16

James W. Daly

The anatomic theory of the radical hysterectomy was described by the German surgeon Ries in 1895, but it was performed for the first time by an American, John Clark, at Johns Hopkins Hospital.[10] In 1898 Wertheim began to do this operation for carcinoma of the cervix, and in 1912 he published a monograph that included 500 cases.[11] This procedure, together with the Schauta vaginal hysterectomy, became the mainstay of the surgical attack on cervical cancer in Europe and Great Britain. However, in the United States, radium and then radium and external radiation therapy were the most commonly practiced methods of treatment for cervical cancer until Meigs reintroduced radical hysterectomy and bilateral pelvic node dissection to American surgeons in 1944.[5] Meigs, in contrast to the European surgeons, advocated complete and routine removal of the pelvic lymph nodes in every case. Interestingly enough, the radical abdominal hysterectomy is often called the Wertheim operation in the United States, whereas many European surgeons refer to it as the Meigs operation. The procedure described in this chapter is based largely on the technique first described by Okabayashi in 1921[6] and expanded by Yagi in 1955.[12]

Radical hysterectomy and pelvic node dissection is a proven and time-honored method of cure for the smaller Ib and IIa carcinomas of the cervix. The procedure allows an immediate and detailed evaluation of the extent of the tumor, and in younger women it is possible to preserve ovarian function. In the smaller cervical cancers it is unusual for metastasis to occur in the adnexae; therefore, their removal is not necessarily part of the operation. Of great advantage is the avoidance of late radiation damage to the pelvic tissues and organs such as the small bowel, bladder, and rectum.

The operation is not suitable for patients with large cervical tumors and those that extend beyond the medial third or half of the paracervical and paracolpal tissue. It is probably best to treat patients with parametrial disease with radiotherapy since it is often difficult to get beyond the tumor with a surgical approach. Elderly patients (those over 65 or perhaps 70) and those with a compromised pulmonary or cardiovascular system may do better with radiotherapy. Patients who are extremely obese are technically difficult to operate upon; bleeding in these patients may be extremely troublesome.

A significant disadvantage to the operation described in this chapter is postoperative bowel and bladder denervation and dysfunction.[9] If one is not prepared to handle this problem postoperatively and teach the patient how to use her bladder and to take care of her bowels, then one should not use this particular technique.

All patients operated on with this technique will have some degree of bowel and rectal denervation and subsequent dysfunction. The magnitude of the problem will vary from patient to patient, but they all have some injury and the situation is usually permanent. However, with proper care and teaching, the patient can overcome these difficulties and lead a normal life without any significant degree of renal damage.[7,9] Gal and Buchsbaum demonstrated that 87% of patients have ureteral dilatation proximal to the site of pelvic dissection at 48 hours, persisting in most cases for 7 days.[1] By 6 weeks dilatation has regressed and pyelograms are normal. The incidence of ureteral and bladder fistulas has significantly decreased over the years from 15% to 2% or less.[4] In Symmonds' series reported by Hoskins et al,[2] there were no urinary fistulas in 64 patients. Our own ureteral fistula rate was 1% in 100 operations. A larger number of patients will ultimately develop ureteral strictures, perhaps 6% overall. A few patients will have incision into the rectum during the operation, and in that case it is usually best to perform a colostomy; however, if these rectal injuries are properly repaired, the colostomy can later be taken down and closed. The blood loss will vary from 1,000 to 4,000 mL, and on occasion may be even higher, but the average is probably somewhere between 2,000 and 2,500 mL. Occasionally a patient develops a postoperative lymphocyst, but it is generally asymptomatic and causes no significant problems. It can, however, obstruct the ureter or become infected, or both, and in that instance further surgery is necessary.

Preoperative Evaluation

The diagnostic evaluation of the patient with carcinoma of the cervix begins with a detailed history and physical; for it is only after this examination that one can determine whether a patient is truly a technical or medical candidate for the surgical approach. The patient should have a chest x-ray study and an intravenous pyelogram and, if she is 40 years of age or older, an electrocardiogram. Cystoscopic examination should be done in the larger cervical lesions, but in those where the lesion is small and obviously confined to the cervix, cystoscopy is not necessary.

The patient should have a complete blood count and a urinalysis with a urine culture. It is also wise to culture the cervix for gonococcus; if the patient develops a postoperative gonococcal infection the complications can be severe. Blood urea nitrogen, serum creatinine, and electrolytes should be obtained. Prior to surgery, a colposcopic examination should be performed so that a mucosal lesion in the vagina is not overlooked.

Operative Technique

The surgical anatomy involved in this procedure is discussed in Chapter 15. The operation is designed to remove the primary tumor and the regional tissue into which contiguous spread of the cancer occurs as well as the primary (pelvic) and, less often, secondary nodes (aortic). The technique is illustrated in Figs. 16-1 through 16-18.

The tissues that may contain contiguous spread are the paracervical and paravaginal tissues and the upper third of the vagina. These paracervical and paravaginal tissues are in essence the cardinal and the uterosacral ligaments. In stages I and IIa disease up to 25% of patients may have nodal

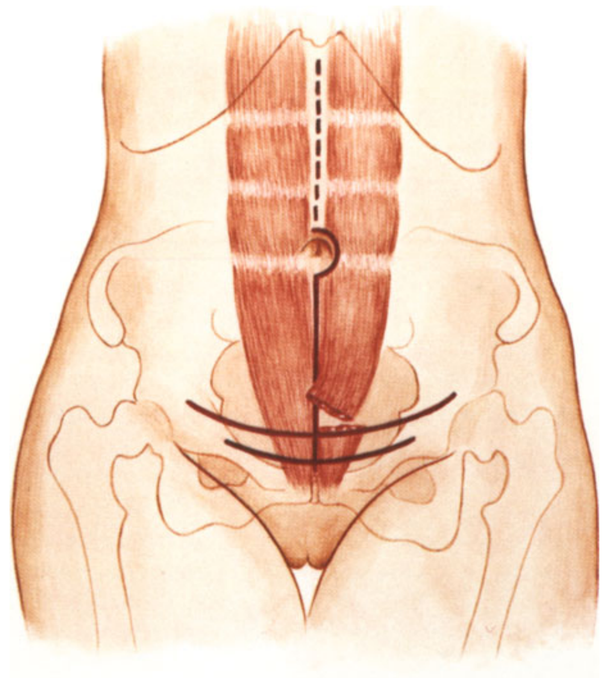


FIGURE 16-1. Open the abdomen through a midline incision from the xyphoid to the pubis, passing to the left of the umbilicus. While a muscle-cutting, lower abdominal transverse incision produces good exposure of the pelvis, para-aortic lymph node dissections or biopsies are compromised through this incision. Carefully explore the abdomen, including the liver and para-aortic and pelvic nodal areas. Biopsy any suspicious areas on the peritoneal surface and obtain any free fluid in the abdomen for cell washings. Make certain the stomach is empty and was not distended during the induction of anesthesia. A Levine tube is used to keep the stomach decompressed and in the postoperative period for the management of ileus, which frequently occurs with para-aortic nodal dissection. Pull the transverse colon anterior to the wound and cover it with moist laparotomy tape.

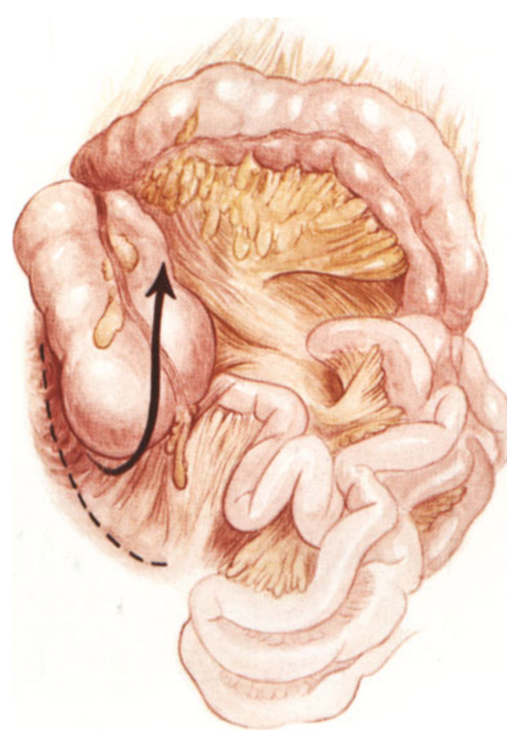


FIGURE 16-2. Grasp the uterus at the cornual areas with Masterson clamps and pull sharply to the left, putting the right round ligament on tension. Ligate and divide the round ligament close to the right pelvic wall. Open the peritoneum inferiorly to where the external iliac artery exits the abdomen; place a medium Deaver retractor at this lower margin. Incise the peritoneum in a cephalad fashion up the right peritoneal gutter lateral to the cecum for 10 cm. Lift the cecum and put tension on the medial peritoneum. If no retroperitoneal dissection is planned, proceed to Fig. 16-8.

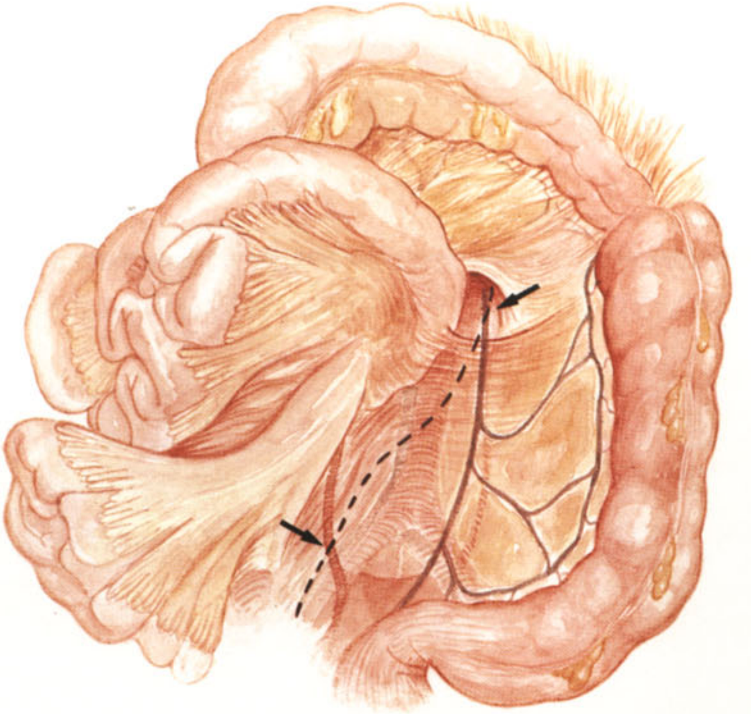


FIGURE 16-3. Transfer the small bowel to the patient's right side, maintain the tension on the peritoneum, and incise with a scissor diagonally across the abdomen, following the route of the small bowel mesentery up to the ligament of Treitz. Use a fiberoptic light to transilluminate, avoiding the right ovarian vessels, ureter, and inferior mesenteric vein. Carefully identify the structures in the left retroperitoneum as the overlying colon and superior rectal artery obscure their identification. Identify both ureters, as they are the margins of this dissection. Secure any small bleeders with clips or cauterization and avoid staining the retroperitoneal fat as this makes dissection more difficult. Exteriorize the small bowel and cover it with warm laparotomy tapes. Place a wide Deaver at the margins of the duodenum to produce exposure to the upper margins of the wound. Use care with the upper abdominal retractors to avoid injury to the liver and spleen and pressure necrosis of the underlying colon. Frequently check the retractors to make certain no injuries are being produced.

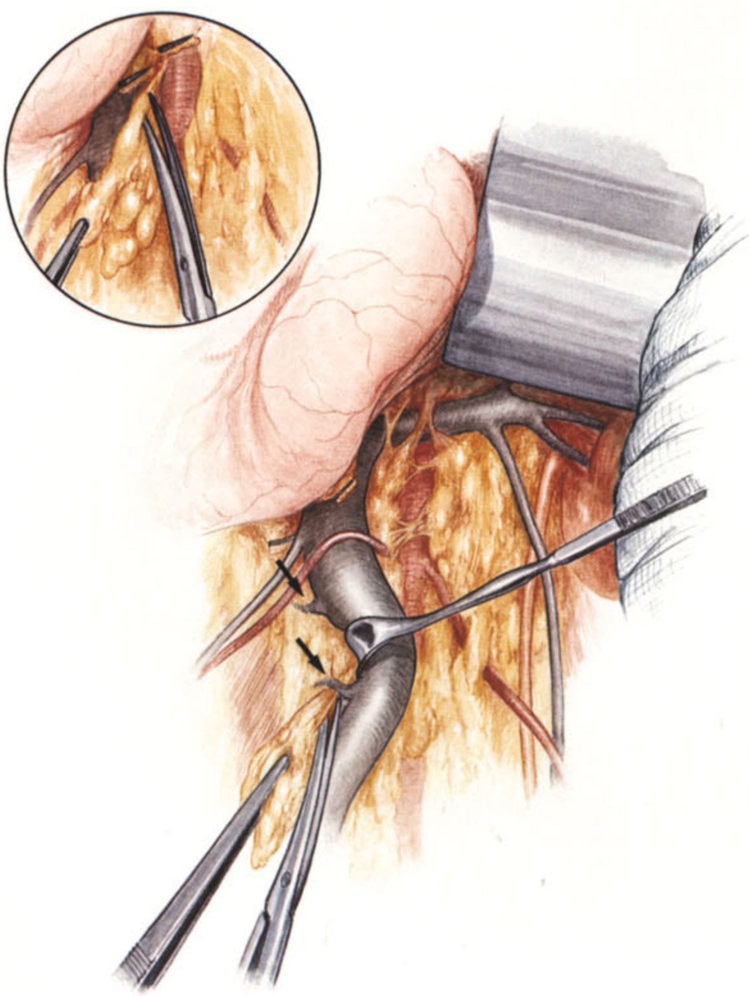


FIGURE 16-4. Begin the dissection in the area of the right common iliac vein by grasping the fibroareolar tissue with Adson-Brown thumb forceps and pull up sharply. Dissect upward over the vena cava in this plane to the duodenum as it crosses the aorta and vena cava. *Inset:* Carefully expose the left renal vein with the large Deaver retractor and remove the nodes about and inferior to it using small clips, long delicate Nelson scissors, and long Adson-Brown thumb forceps. Avoid damage to the lumbar veins, which enter the vena cava in this area.

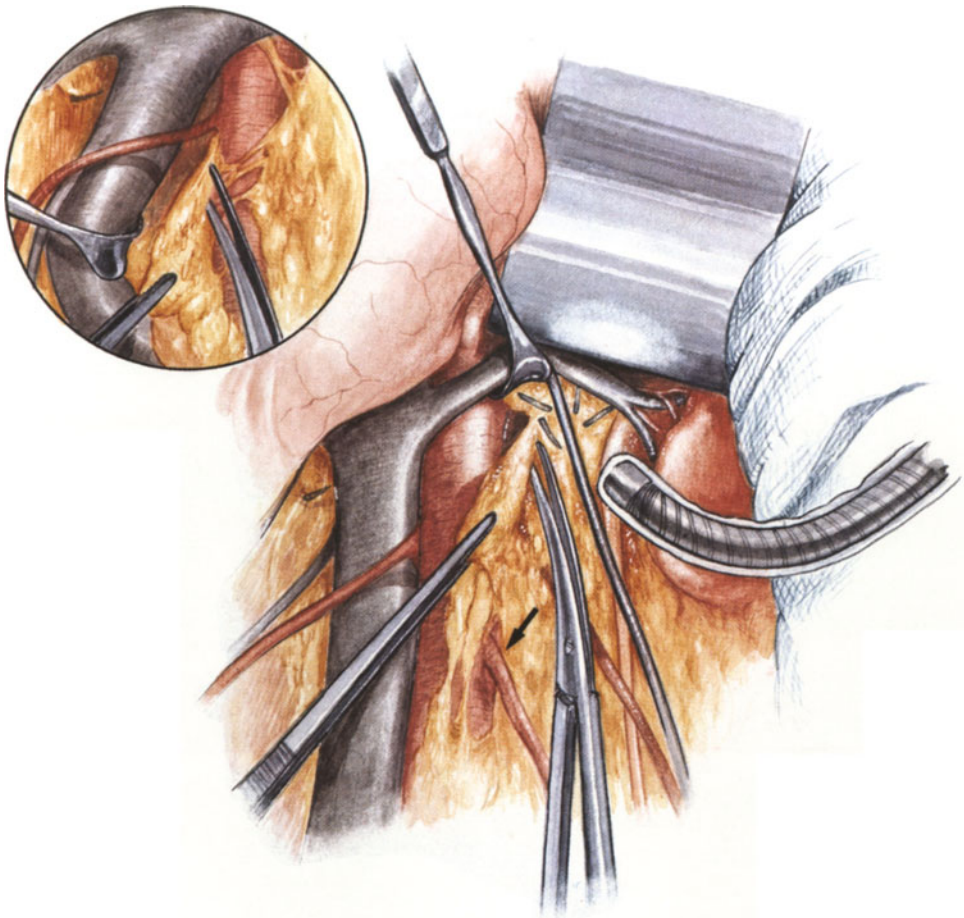


FIGURE 16-5. Pull the vena cava to the right with the long vein retractor and remove the nodes lying between the vena cava and aorta (*inset*). Secure these lymphatics with small clips. Enter the adventitial sheath over the aorta and identify the inferior mesenteric artery, which exits the aorta superior and lateral to the bifurcation. Although shown preserved in these drawings, the inferior mesenteric may be sacrificed without undue risk if this will facilitate exposure or dissection. Clamp the inferior mesenteric artery loosely with a Gemini clamp and observe any vascular changes in the lower colon. If no evidence of vascular insufficiency is noted in the colon, ligate the inferior mesenteric with 2–0 nylon and secure with an additional suture ligature. Continue the dissection anterior to the aorta up to the duodenum to the level of the left renal vein. Lift this vein with a vein retractor and secure the lymphatics at this level with multiple clips. Remove the node chain and dissect lateral and inferior to the aorta to remove the additional group of nodes in that location. Be certain to secure the upper margin of this chain of nodes as they go under the renal vein to avoid lymph accumulations in the retroperitoneum.

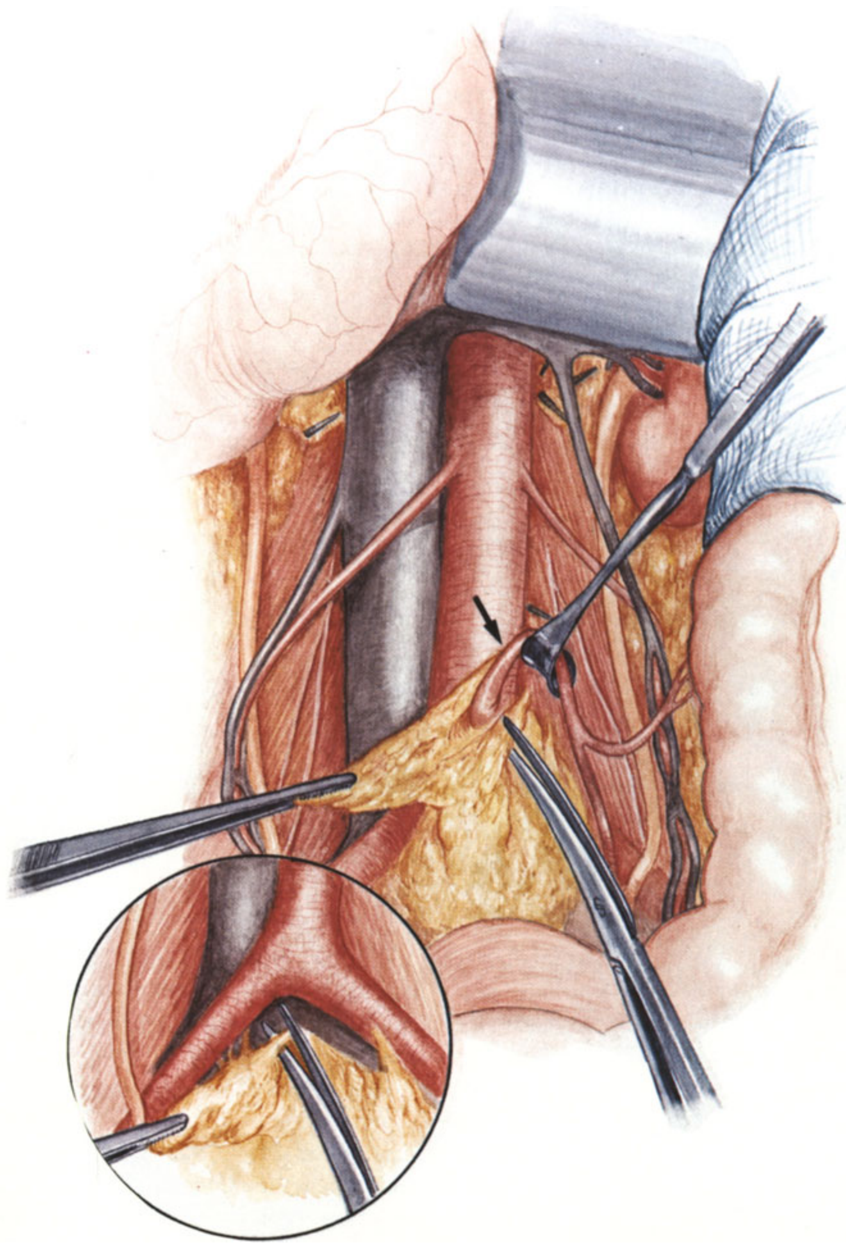


FIGURE 16-6. Bring the nodal mass downward toward the pelvis and dissect it free of the inferior mesenteric artery. Again, pay attention to the lumbar vessels as they exit the aorta in this area. Dissect the nodal chain downward anteriorly and superior to the common iliac artery to the point where the ureter crosses this vessel. Perform a similar dissection on the right side and remove the fat pad overlying the bifurcation of the vena cava which often contains nodal tissue. *Inset:* Remove the remaining common iliac nodes from around the common iliac artery and vein to the point where the ureter and ovarian vessels cross the bifurcation of the common iliac artery. Avoid injury to the ureter by constant visualization. Continuously monitor retraction on the upper abdominal viscera as the deep retractors may produce the injuries previously noted. Remember that vascular anomalies are common, particularly in the venous system, and be alert to isolate and clip such unsuspected vessels. Save time by placing a dry pack against a small vessel that is difficult to visualize and dissect in other areas. Often the bleeding will have stopped after a period of pressure application. Avoid mass ligation of lymphoid tissue in the upper reaches of the incision as damage to branches of the celiac axis or other abdominal vessels may occur if the area is not well exposed.

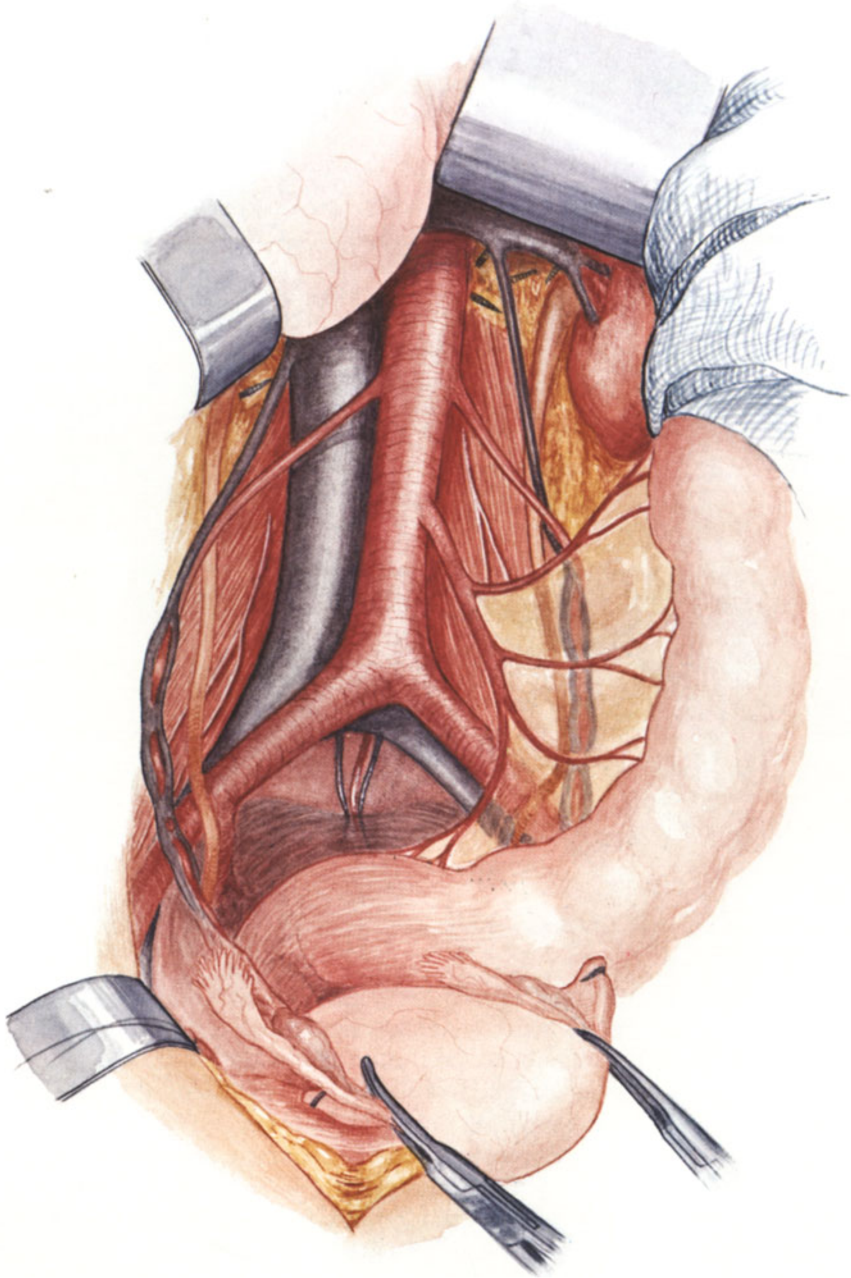


FIGURE 16-7. Drains are not required following completion of this procedure. Close the peritoneal incision with continuous 2–0 or 3–0 absorbable suture. Carefully inspect the upper abdominal viscera, colon, and small bowel; replace them in the abdomen with warm packs; replace the large Deaver retractors above and proceed with distal lymph node dissection.

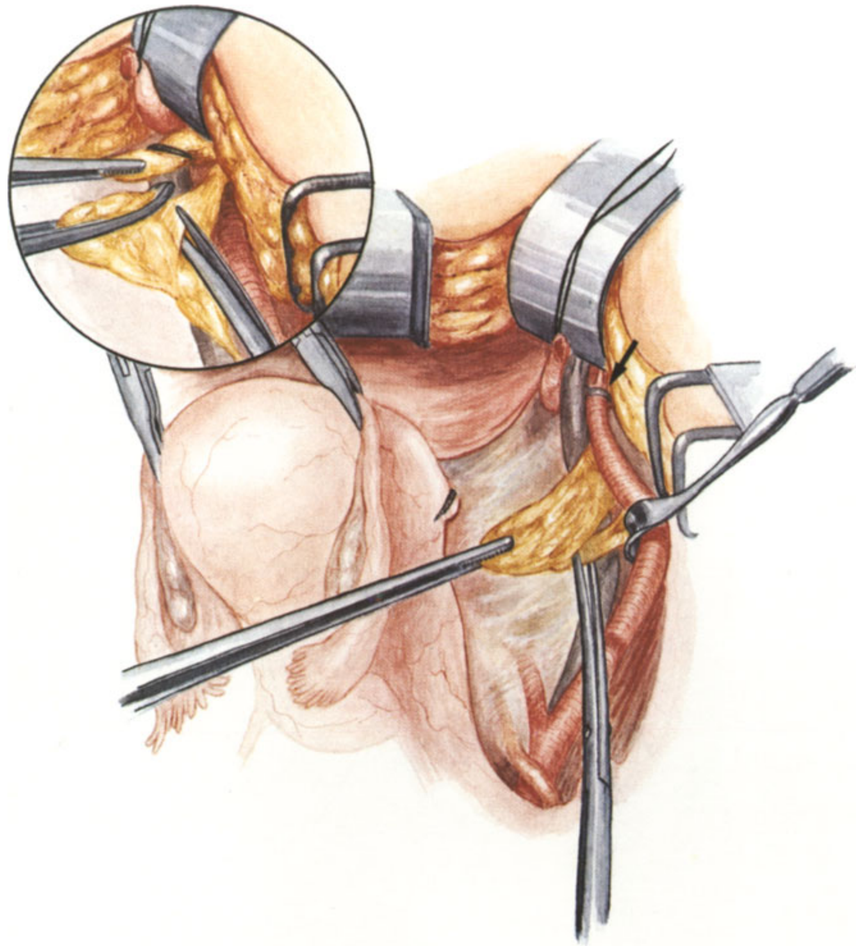


FIGURE 16-8. Identify the ovarian vessels and separate them from the ureter. Doubly ligate the ovarian vessels with 2–0 nylon employing a distal suture ligature, and clip the specimen side vessels; divide them between the uterus and ovary if they are to be retained. Continue the lymphadenectomy by extending the dissection plane in the adventitia of the great vessels along the anterior surface of the external iliac artery to the point where the vessel leaves the abdomen. Avoid or clip the circumflex iliac vein at the arrow as it crosses anterior to the external iliac artery. Dissect the fibrofatty tissue and lymph nodes along the psoas muscle and genitofemoral nerve and direct these medially. Avoid severing the genitofemoral nerve. Pull the nodal tissues medially near the inguinal ligament, exposing the external iliac artery and vein. Medial to the external iliac vein, lymphatic tissue and numerous lymphatic channels from the groin should be pulled upward and clipped. *Inset:* Dissect downward toward the pelvic floor into the paravesical space and enter the adventitial sheath covering the external iliac vein. Dissect these tissues free using Adson-Brown thumb forceps, long delicate Nelson chest scissors, and sponge sticks to produce planar tension on the tissues.

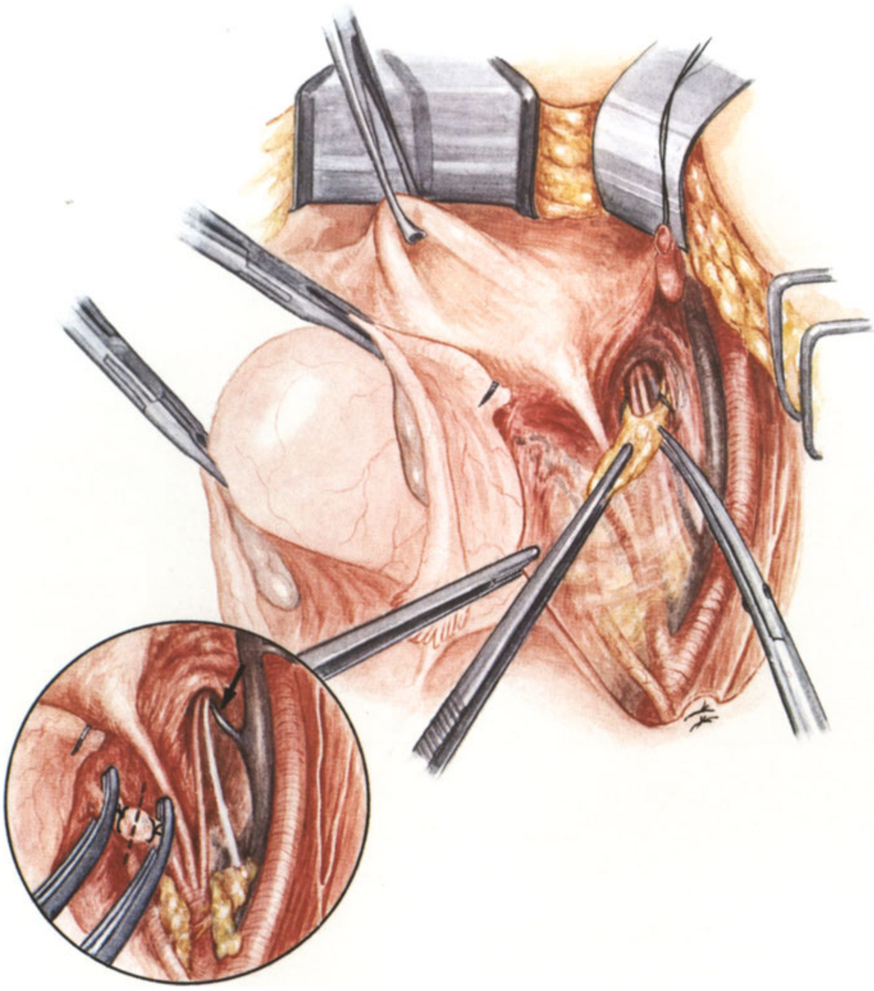


FIGURE 16-9. Continue the dissection cephalad between the external iliac artery and vein and reflect these tissues medially. Clip the rather constant bleeder at the junction of the external and internal iliac artery and vein securely. Expose the obturator nerve, artery, and vein. The nerve is easily palpated. Secure the vein if necessary with a small clip and dissect this node group upward and medially. With initial entrance into the pelvic floor through the paravesical space, the great vessels along the pelvic wall and ureteral entrance into the pelvis are now clearly seen. Isolate and preserve the superior vesical artery and the artery to the ureter from the internal iliac arising 2 to 3 cm from the bifurcation. *Inset:* Irrigate the pelvis and secure any bleeders. Follow the ureter downward and identify the uterine artery. It is usually serpiginous and most commonly arises from the internal iliac or superior vesical artery. Elevate it with a Gemini clamp and doubly ligate with 2–0 or 3–0 nonabsorbable suture. Leave the specimen side long for ease in identification when dissecting the ureteral tunnel. Note the anomalous obturator vein at the arrow; a variety of vascular patterns are found in the pelvis. Perform a similar dissection on the opposite side by pulling the uterus sharply to the right; enter the retroperitoneum by dividing the round ligaments as before, and initiate the dissection of the plane anterior to the external iliac artery. Strong traction with Masterson clamps upward toward the patient's right shoulder will produce the best initial exposure.

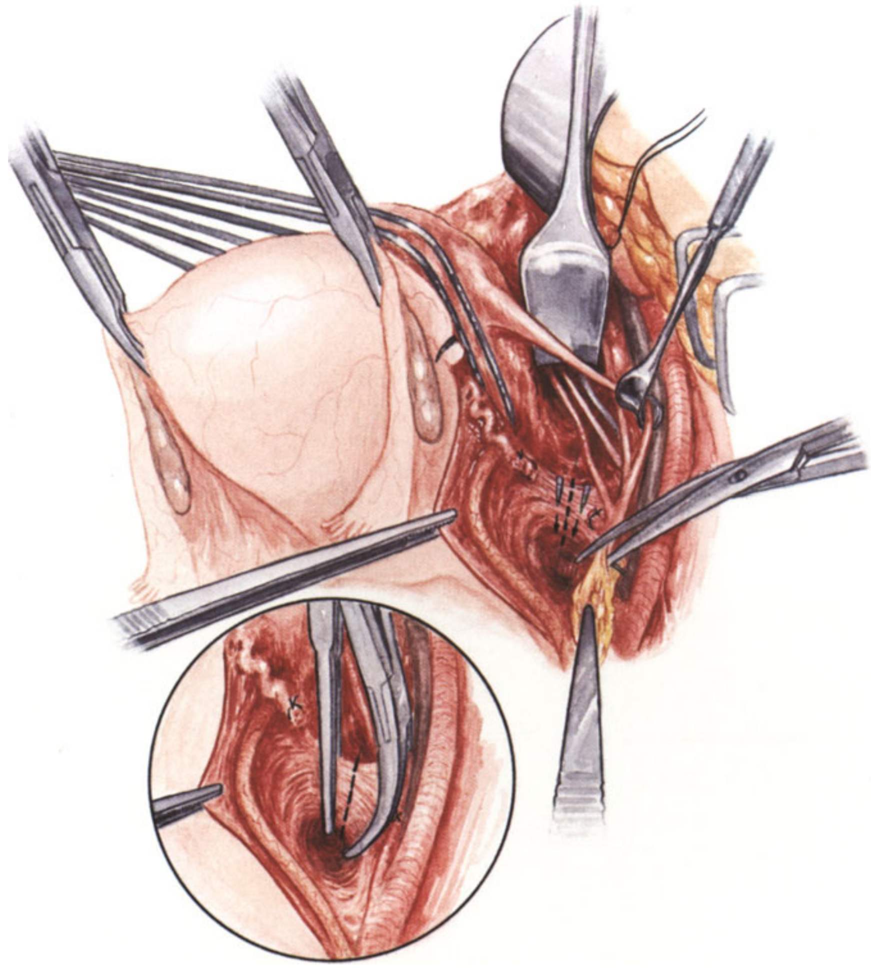


FIGURE 16-10. Complete nodal removal of any tissues lying in the perirectal space and bluntly dissect both the pararectal and paravesical spaces to the floor at the levator muscles. Pull the superior vesical artery from the area with a vein retractor and visualize the cardinal ligament (web) separating the paravesical and pararectal spaces. If slender, secure with a row of clips and divide sharply. Remember that once employed it is difficult to apply a clamp across clips if they do not work. *Inset:* The web may be clamped by a long curved Masterson clamp to the pelvic wall and may be secured with a swaged 0 chromic gut or heavy silk figure-of-eight sutures. A straight Masterson clamp may be applied medially on the specimen or the vessels may be clipped. When clips are applied, remember that strong traction may avulse them from the vessels and the area should be inspected to avoid unsuspected blood loss. When pelvic wall bleeding occurs, figure-of-eight sutures or clips may be needed. Do not suture too deeply as the sciatic nerve lies close by.

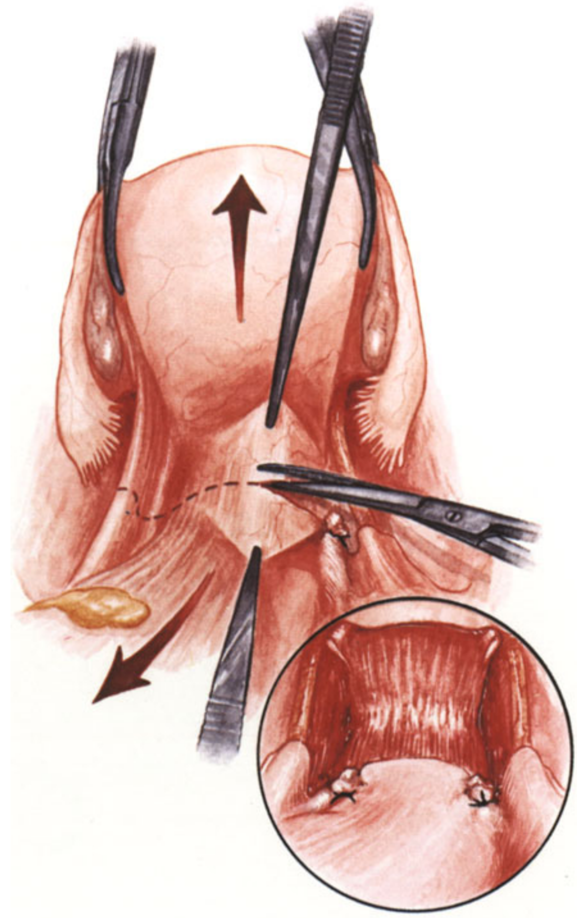


FIGURE 16-11. Pull the uterus sharply and firmly toward the pubis, putting the rectum in tension. Open the peritoneum across the cul-de-sac, being careful of the ureters on each side. Sharply dissect the rectum down 3 to 4 cm from its attachment to the vagina. Identify the uterosacral ligaments on each side; they are best identified by palpation between the surgeon's fingers. Divide and clip with large clips, referring to the uterosacral ligament. *Inset:* Carry this dissection down parallel to the sacrum and toward the vagina. It is necessary to ligate the uterosacrals on both sides owing to the hemorrhoidal vessels in these ligaments. The uterus will rise out of the pelvis as these ligaments are severed. Continue the dissection until all palpable uterosacral ligaments have been divided.

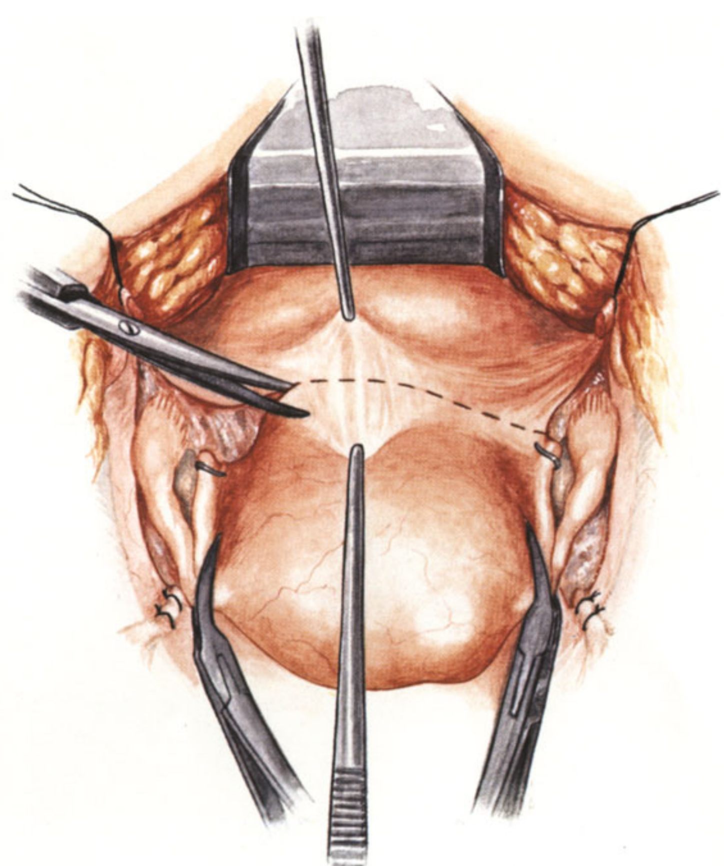


FIGURE 16-12. Pull the uterus up cephalad and open the vesicouterine fold. The anterior bladder pillars are clamped with Gemini clamps and suture ligated with fine absorbable suture.

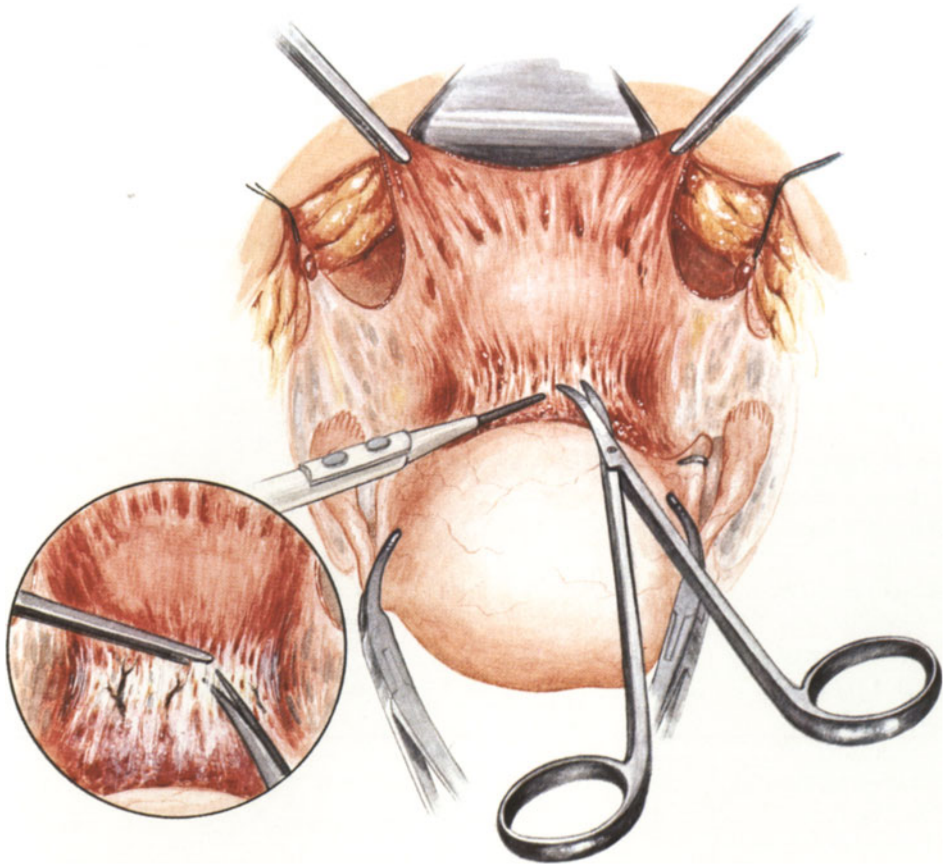


FIGURE 16-13. Grasp the bladder with Adson-Brown thumb forceps and sharply dissect the bladder off the anterior vagina for 5 to 6 cm. This utilizes the same plane as simple hysterectomy; however, the dissection is more extensive and the vaginal muscularis should be left intact using the vesical margin of this plane.

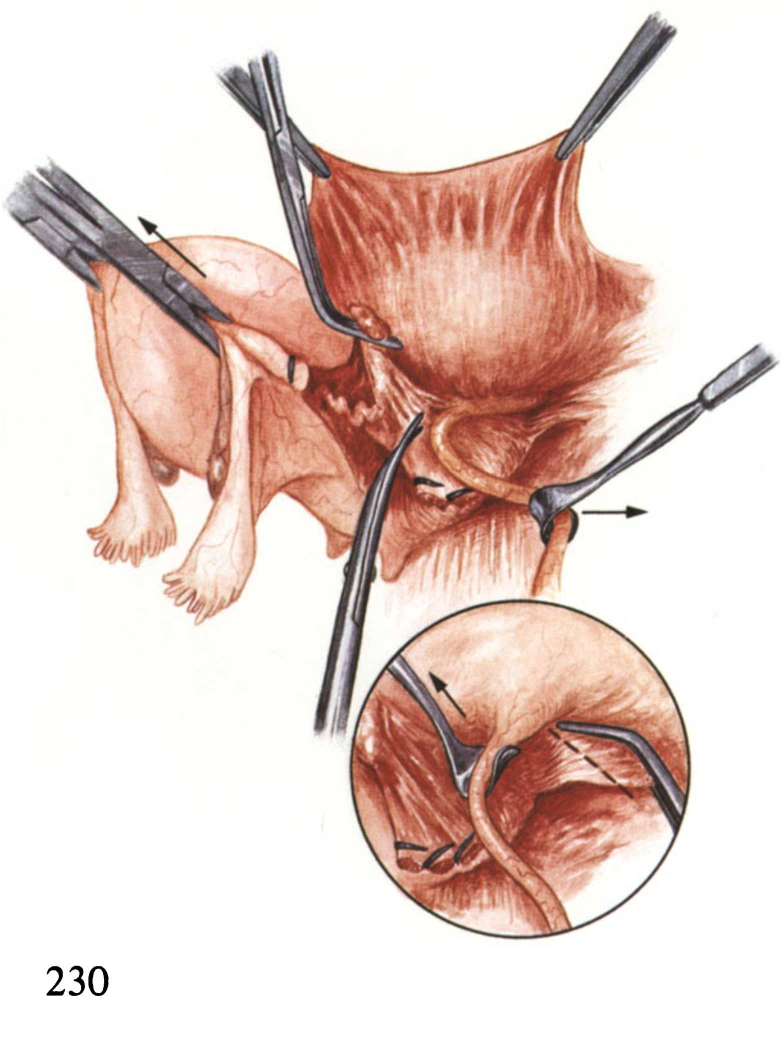


FIGURE 16-14. Free the ureters from the medial peritoneum just cephalad to the uterus and hold the ureters laterally, defining the ureteral tunnel. Pull the uterus strongly to the opposite side and cut the ureters from their tunnel with fine sharp Metzenbaum scissors. Ligate any bleeders. This dissection is facilitated by pulling sharply upward with Gemini forceps on the stump of the uterine artery, freeing the ureter all around with sharp dissection. Dissect holding the ureter downward as the lower vagina is approached and sever the ureteral vaginal attachment with scissors. The ureteral tunnel is comprised of numerous venous sinusoids attached to both bladder and vagina and is variable in size. *Inset:* If thin, only sharp incision is required along the dotted line. If more substantial, individual clamps with Gemini clamps and 3–0 or 4–0 absorbable suture may be required. Do not employ clips this near the vaginal margin, on the bladder, or in the bladder muscle.

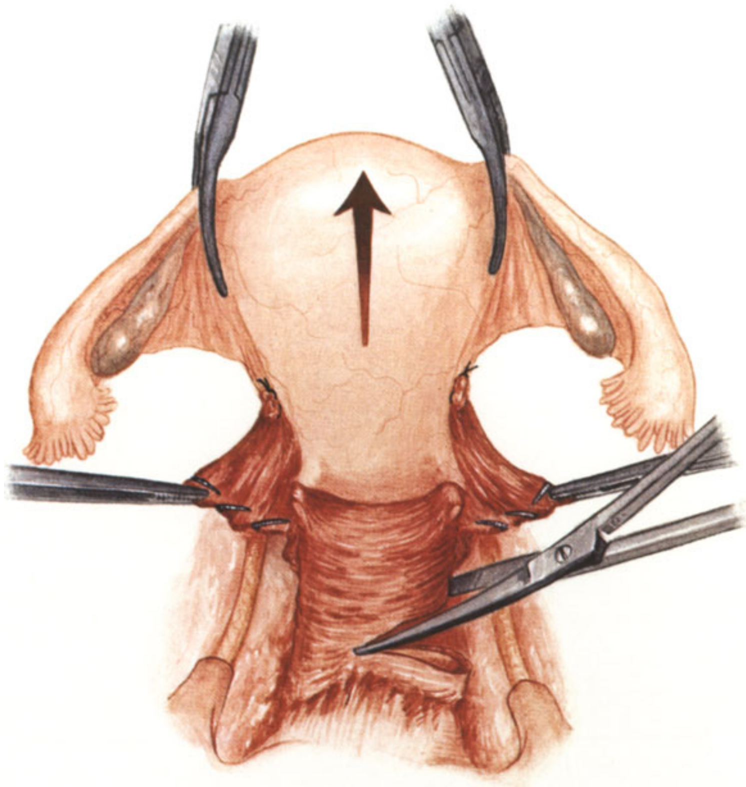


FIGURE 16-15. Hold the uterus upward anteriorly and sever any remaining uterosacral or other ligamentous structures. Hold the stumps of the cardinal ligaments away from the uterus and any remaining lateral bladder pillars will become apparent. These structures contain nerve tissue and may contain several large veins. Clamp and suture ligate any remaining vessels. Dissect any remaining bladder off the anterior surface of the vagina to the chosen margin of excision. Clamp the tissue lateral to the vagina with Masterson clamps, transect, and suture ligate these remaining tissues. Cut across the vagina above the bladder and rectal reflection. Secure the remaining vagina anteriorly, laterally, and posteriorly with Allis clamps.

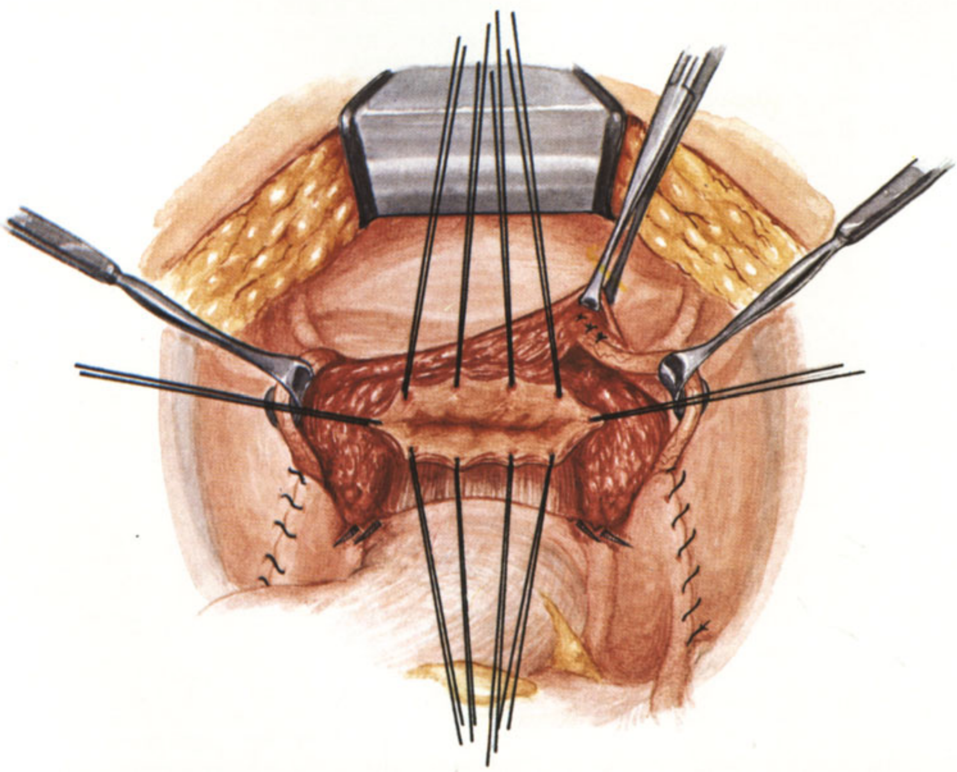


FIGURE 16-16. Ligate the edges of the open vagina with a figure-of-eight suture. Do not use a running lock as this narrows the vaginal opening. Tie the sutures but leave them long. Irrigate the pelvis copiously with saline and seek any remaining bleeders. Catch the edge of the bladder where the superior vesical artery joins the dome and hold it on tension. Support the ureter with the superior vesical artery for 3 to 4 cm cephalad to the bladder, taking care not to obstruct either structure. Place sump drains through separate stab wounds beneath the tied round ligaments and place them medial to the pelvic vessels but lateral to the ureter. Place the tip of the sump in the obturator fossa.

FIGURE 16-17. Sew the bladder flap anterior to the anterior vaginal wall using long chromic sutures previously placed in the vagina; sew the posterior vaginal flap to the rectal peritoneum in a similar fashion. Reperitonealize the area lateral to the vagina for several centimeters in a smilar fashion. Sew the peritoneum covering the bladder to the peritoneum covering the rectum such that a pouch of open vagina is created. The ureters are now in the peritoneal cavity. Prepare a hammock for them by oversewing the peritoneum over the distal ureter, making certain that no stricture exists where the ureter enters the peritoneal tunnel. Sew the peritoneum over the ureters and complete any peritoneal closure if necessary near the aorta. If the peritoneum is of poor quality due to heavy irradiation or adhesions, the ureters may be placed extraperitoneally and the remaining peritoneum may simply be closed after the vaginal vault is closed with interrupted Smead Jones sutures of 3–0 absorbable suture. This produces a closed vagina and places the ureters in an extraperitoneal fashion. If no peritoneum remains be certain to close the vagina and prepare an omental carpet to cover the pelvis and distal ureters.

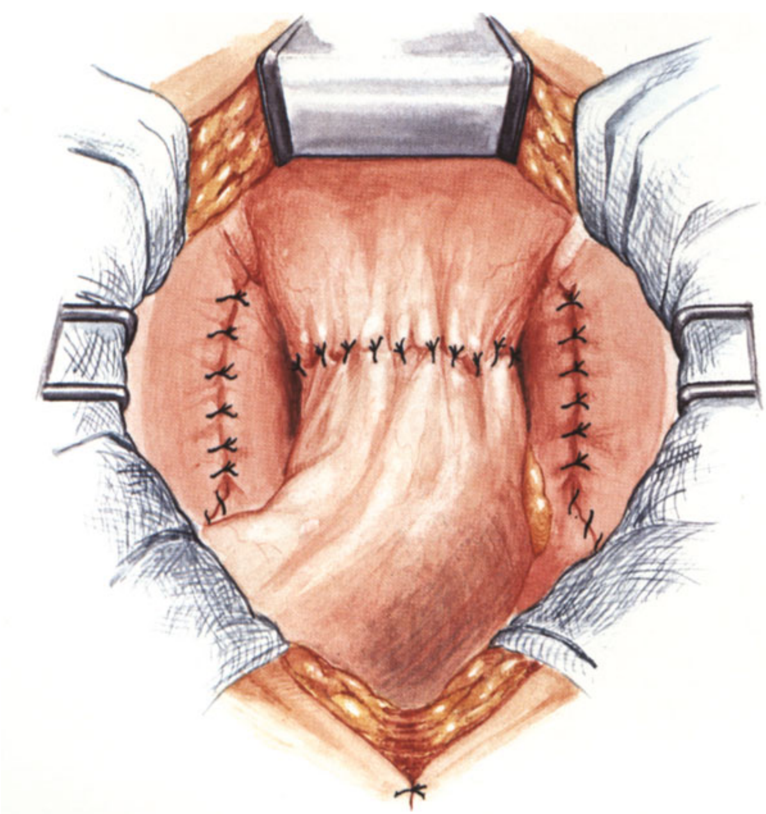


FIGURE 16-18. Following complete reperitonealization, place the drains extraperitoneally and attach them to suction. The lengthened vagina lies in the midline. The aortic peritoneum incision should meet the lower pelvic closure. Obtain careful needle and instrument counts, remove all laparotomy packs from the abdomen, and close the wound in layers of 0 braided nylon or wire in a Smead Jones fashion. No subcutaneous stitches are used and the skin is closed with 3–0 nylon or clips.

metastasis. These patients have a 5% to 10% chance of also having para-aortic disease. About 25% of the patients who have pelvic nodal metastasis also have para-aortic spread, so when there is definite evidence of nodal disease in the pelvis, it is probably wise to perform a para-aortic node dissection. Therefore, in the complete operation the nodes along the aorta and vena cava from the renal vessels down are removed, along with the lymph nodes in the pelvis. The uterus and upper third of the vagina are also removed, along with almost the entire uterosacral and cardinal ligaments. The operation is useful for cancers confined to the cervix, i.e., the smaller stages Ib and IIa cancers, carcinoma of the upper vagina, and stage II carcinoma of the endometrium.

In most patients with recurrent cervical cancer after radiation, this type of operation will not be suitable because of the size of the tumor, the involvement of adjacent organs, or prior radiation therapy. However, in very selected patients, radical hysterectomy may be suitable, although one must be willing to accept a higher complication rate owing to the devascularization of the pelvis following radiation therapy.

Postoperative Management

On the morning of operation the patient is given 2,500 units of heparin subcutaneously to prevent pulmonary emboli. This dose is administered every 12 hours until the patient is fully ambulatory. Rosenshein et al obtained excellent results with single dose doxycycline, 200 mg intravenously, given prior to surgery.[8] In our experience postoperative infection is reduced with the use of prophylactic antibiotics. At the present time we are using cefazolin, 1 g intravenously or intramuscularly, given 1 hour prior to surgery and then repeated every 6 hours for two doses.

Pelvic node dissection will predispose the patient to a large postoperative and intraoperative loss of serum and serum albumin. Therefore, this serum protein should be monitored postoperatively and replaced if the serum albumin falls below 2.5 g per deciliter.

Another problem that occurs with retroperitoneal dissection is an accumulation of lymph and serum along the pelvic sidewalls that may become infected or ultimately lead to a lymphocyst. Therefore, both sides of the pelvis and the deep pelvic cavity should be drained. Sump or Jackson-Pratt drains work equally well. The sumps are left in until each side drains less than 30 mL a day; this usually occurs on the fourth or fifth postoperative day.

The third problem associated with retroperitoneal dissection is ileus. It is therefore wise to insert a nasogastric tube during the operation and maintain the patient on nasogastric suction for several days. Once the patient's bowel activity has returned and she is passing flatus, the tube can be withdrawn.

The operation described in this chapter will almost completely remove all the autonomic nerves to and from the bladder and, to a lesser extent, the rectum. The usual postoperative hospital stay is 7 to 10 days. Postoperatively the patient will have little, if any, bladder sensation, and alarming amounts of urine may accumulate in the bladder. It is necessary to leave a Foley catheter or, if one chooses, a suprapubic cystotomy catheter in the bladder for 4 to 6 weeks postoperatively. Then the catheter is withdrawn and the urine cultured. The patient is then taught to use the Crede maneuver (suprapubic pressure) and is told to void every 2 or 3 hours during the day, by the clock, using the abdominal musculature and the mechanical pressure of the hands to completely evacuate the bladder. She is also told to use a mild laxative such as milk of magnesia and to keep her bowel working and as empty as possible. The patient returns after 1 week, and the residual urine is checked. If it is less than 150 mL the catheter can be left out. It is necessary to check the patient again for residual in 1 month and in 3 months, and to continue to reinforce timed voiding with the suprapubic maneuver. The patients will, over a period of time, recover some of their bladder sensation but it is usually not normal.

While the catheter is in place the author gives pharmacologic prophylaxis against infection and maintains this for several weeks after the catheter is withdrawn. Then, when the residual is checked, the urine is again cultured.

Results

Hoskins et al surveyed the recent literature for results of radical hysterectomy and pelvic lymphadenectomy. They analyzed a total of 1,874 cases reported by nine authors and summarized the results as follows[2]:

Survival for stage Ib	81.9%
Survival for stages Ib and IIa	74.2%
Ureterovaginal fistula rate	4.8%
Operative mortality	1.3%

In Symmond's series of 64 patients, included in the 1,874 cases, no urinary tract fistulas were noted.

In our own personal experience using this technique in 24 cases from 1973 through 1975, 23 out of 24 survived for a minimum of 5 years free of cancer. Every individual series will be influenced by material and personal selections of cases. The current Annual Report lists a 5-year survival of 84.2% in stage I cervical cancers treated surgically.[3]

References

1. Gal D, Buchsbaum HJ: A cinefluoroscopic study of ureteral function following radical hysterectomy. *Obstet Gynecol* 1983; 61:82–86.
2. Hoskins WJ, Ford JH, Lutz MH, et al: Radical hysterectomy and pelvic lymphadenectomy for the management of early invasive cancer of the cervix. *Gynecol Oncol* 1976; 4:278–290.
3. Kottmeier HA (ed): The annual report of the results of treatment in gynecologic cancer: Statement of results obtained in 1973 to 1975 inclusive. Vol. 18. Stockholm, International Federation of Gynecology and Obstetrics, 1982.
4. Macaset MA, Lu T, Nelson JH Jr: Ureterovaginal fistula as a complication of radical hysterectomy. *Am J Obstet Gynecol* 1976; 124:757–760.
5. Meigs JV: Carcinoma of the cervix—The Wertheim operation. *Surg Gynecol Obstet* 1944; 78:195–199.
6. Okabayashi J: Radical abdominal hysterectomy for cancer of the cervix uteri. *Surg Gynecol Obstet* 1921; 33:335–341.
7. Roman-Lopez JJ, Barclay DC: Bladder dysfunction following Schauta hysterectomy. *Am J Obstet Gynecol* 1973; 115:81–90.
8. Rosenshein NB, Ruth JC, Villar J, et al: A prospective randomized study of doxycycline as a prophylactic antibiotic in patients undergoing radical hysterectomy. *Gynecol Oncol* 1983; 15:201–206.
9. Seski JC, Diokno AC: Bladder dysfunction after radical abdominal hysterectomy. *Am J Obstet Gynecol* 1977; 128:643–651.
10. Speert H: *Obstetric and Gynecologic Milestones: Essays in Eponymy.* New York, Macmillan, 1958.
11. Wertheim E: The extended abdominal operation for carcinoma uteri: Based on

500 operated cases (Gradd H transl). *Am J Obstet Gynecol Dis Women Child* 1912; 66:169–232.

12. Yagi J: Extended abdominal hysterectomy with pelvic lymphadenectomy for carcinoma of the cervix. *Am J Obstet Gynecol* 1955; 69:33–47.

Bibliography

Nelson JH, Jr: *Atlas of Radical Pelvic Surgery,* 2nd ed, New York, Appleton-Century-Crofts, 1977

17 Myomectomy

Leiomyomas of the uterus occur in approximately 20% of women over 30 years of age in this country.[12] Of the women who have leiomyomas of significant size, approximately 40% demonstrate infertility[15]; 50% of the patients in whom no other cause of infertility is demonstrated become pregnant on removal of the myoma.[16] It is apparent that in well-selected patients, myomectomy does increase fertility and it is an alternative for uterine preservation in those patients desiring childbearing capabilities.

The mechanism of myomas in infertility is not known.[16] It is generally agreed that small myomas have little effect on fertility; however, as the size approaches 2 cm, particularly if they are multiple, the incidence of infertility may increase. If the leiomyomas are submucosal in location, they may interfere with proper nidation by distending the endometrium over the leiomyoma, producing a relatively less vascular endometrium. A large leiomyoma may disturb the normal uterine artery and it may also distort the intramural portion of the fallopian tube. Recent research has demonstrated altered uterine contractility when leiomyomas are present. The normal physiologic transport of sperm may be hampered, resulting in infertility.[8] Obviously, the larger the tumor the more difficulty one might anticipate. Additionally, submucosal leiomyomas are commonly associated with menorrhagia and may require treatment prior to or in an interval between pregnancies. Where continued fertility is desired, myomectomy is performed in these patients.

Pathology

The cut surface of leiomyomas will project above the surrounding myometrium and may often compress it. This compression produces a capsule of use in myomectomy. The blood vessels to the leiomyomas enter through this capsule.[5] The arteries are derived from the adjacent uterine vessels and enter the leiomyomas from different poles. They then branch and penetrate toward the center. The blood supply is decreased toward the center of the tumor and degenerative changes usually start there. The veins are usually beneath the capsule. Thus, in myomectomy, the capsule is used as a surgical plane, but sutures are placed through it to provide hemostasis.

Leiomyomas may undergo various degenerative changes. Persaud and Arjoon noted that 65% showed one or more alterations.[13] Hyaline degeneration was most common, but myxomatous, mucoid, cystic, fatty, and red changes were also seen; 8% of leiomyomas calcify, and there is little or no correlation with the clinical picture and the type of degeneration observed.

Preoperative Evaluation

Myomectomy is indicated in those patients in whom a symptomatic lesion exists and in the patient who wishes uterine preservation. If the patient is infertile for 1 year or more and no other cause of infertility is present, myomectomy is suggested. The procedure is reserved for the patient with a leiomyoma larger than 2 cm.

Myomectomy in pregnancy is rarely necessary. Gainey and Keeler noted that only 0.05% of 355,550 pregnancies were complicated by leiomyoma.[6] Stevenson found excellent results in 17 cases of myomectomy during pregnancy, with 83% of the pregnancies progressing to term.[16] In 14 of these patients, subserosal tumors were found. Although undergoing torsion with necrosis, these tumors would not be expected to have significant influence on the uterine cavity. Three of his patients did have intramural leiomyomas, and these were removed without subsequent complication of the pregnancy.

Pelvic examination will generally disclose the presence of a leiomyoma. A uterine sound is used to detect the presence of a submucosal leiomyoma. The patient should have a hysterosalpingogram to document the presence of such a tumor prior to surgery. A dilatation and curettage is performed in all myomectomy patients to rule out the presence of a coexistent malignancy. Hysteroscopy has been reported by Neuwirth to be an alternative to abdominal myomectomy, although he indicates this option is still under clinical investigation.[11]

Operative Technique

If the leiomyoma presents vaginally and the patient desires continued fertility, a tonsil snare is passed over the leiomyoma and it is excised (Figs. 17-1 and 17-2). The patient is placed on antibiotics prior to excision, as these patients usually have associated parametritis due to the inflammatory reaction surrounding the leiomyoma. If the leiomyoma is submucosal or intramural in location, direct incision through an abdominal approach with excision is performed (Figs. 17-3 and 17-4). Subserous myomas do not usually interfere with fertility or produce bleeding problems, and they would not be treated unless large in size. When multiple myomectomies are considered, complete one excision at a time to minimize blood loss.

Cervical leiomyomas are discussed in Chapter 15.

When the surgeon proceeds without delay, no tourniquet or clamps are placed across the uterine blood supply; instead the author recommends the use of a hemostatic solution. Although posterior pituitary extract (Pituitrin) produces a superior vasospastic reaction in the pelvis, its use is associated with cardiac abnormalities, and the author does not recommend it for general use. Six drops of phenylephrine (Neo-Synephrine) in 30 mL of saline is quite satisfactory and is injected into the uterine wall surrounding the mass with a 22-gauge needle. The use of well-placed sutures followed by a brief period of pressure is usually adequate for hemostasis.

Laparoscopic evaluations of myomectomy patients suggest that postoperative adhesions may be a very important factor in subsequent infertility.[3] The author recommends the use of 250 mL of 32% dextran 70 in patients desiring fertility. A recent multicenter clinical trial reported the reduction of postopera-

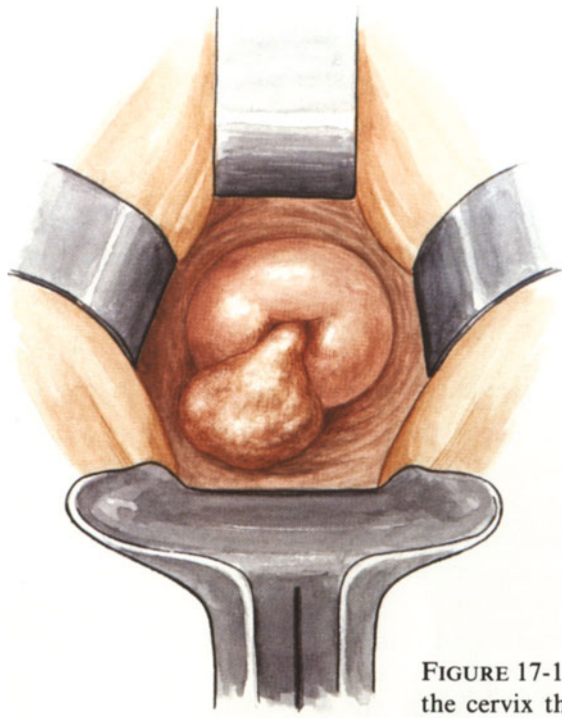


FIGURE 17-1. A leiomyoma presenting through the cervix that is amenable to vaginal excision.

FIGURE 17-2. If the leiomyoma has a relatively narrow stalk, it is removed vaginally with a tonsil snare. *Inset:* Pass the extended wire of the tonsil snare around the leiomyoma and grasp it with thumb forceps. Slide the tonsil snare to the base of the leiomyoma and close it, cutting the pedunculated leiomyoma free. Curette the uterine cavity to make certain that no malignancy has been obscured by the symptoms of bleeding and discharge that usually accompany prolapsed leiomyoma.

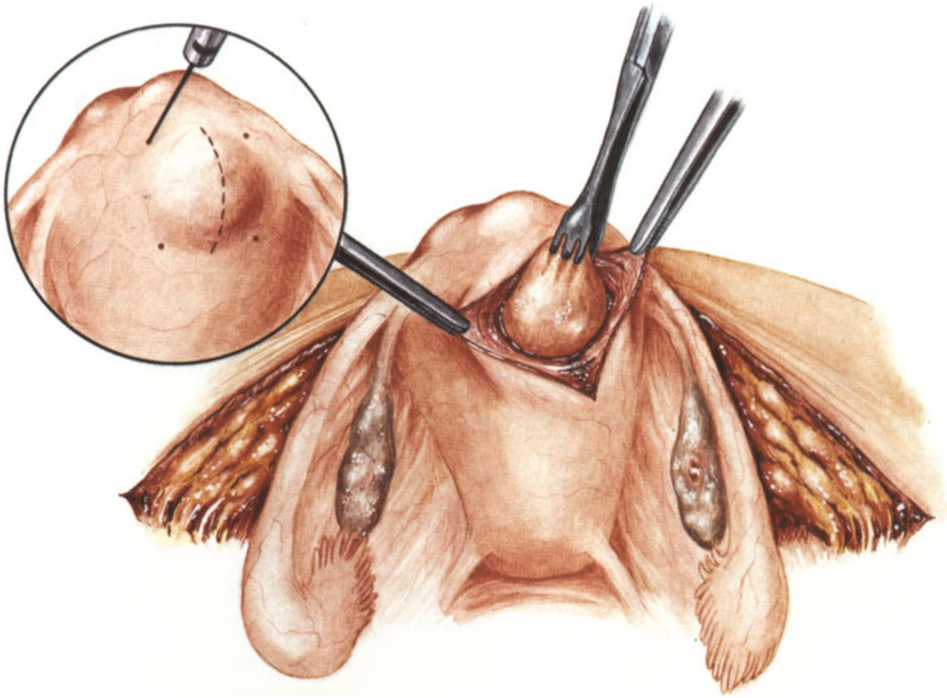


FIGURE 17-3. Inject the leiomyoma with a dilute solution of phenylephrine (Neo-Synephrine) in its periphery in the substance of the capsule where the blood supply originates; make the incision in the capsule overlying the tumor taking care not to incise the tubal lumen (*inset*). Grasp the leiomyoma firmly with the thyroid clamp and pull upward. The plane of dissection lies in the capsule surrounding the substance of the leiomyoma and it may be enucleated from this capsule.

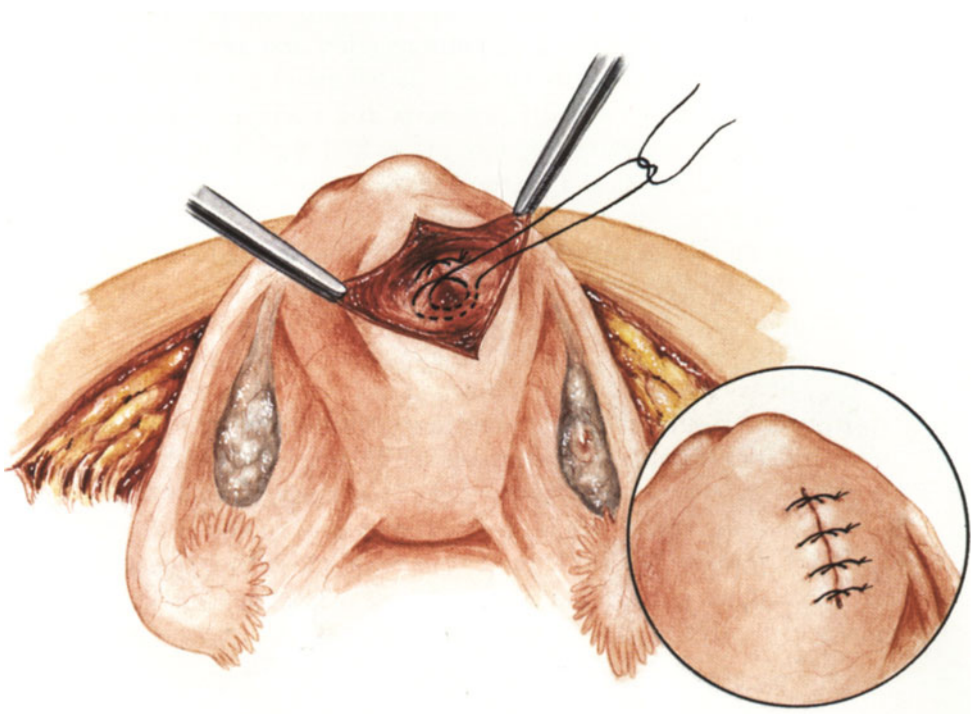


FIGURE 17-4. Close the uterus in two layers. Using 0 absorbable on a general closure swaged needle, place the first layer deep in the substance of the capsule and uterine muscle in a Smead Jones or pulley-type fashion. When the uterine cavity is entered, invert the mucosa but do not close the mucosa as a separate layer. *Inset:* Use the same type of suture in the outer layer to close the uterine defect.

tive pelvic adhesions with the use of 32% dextran 70 and no evidence of clinically significant side effects.[1] This adjuvant therapy, however, is not without problems nor a substitute for meticulous operative technique.

Although the use of the carbon dioxide (CO_2) laser for myomectomy has been reported, the author suggests that it is more a gimmick than a necessity. Currently the CO_2 laser offers little, if any, advantage as a technique for myomectomy.

Postoperative Management and Results

In the vaginal approach the postoperative orders are the same as for a patient who undergoes a dilatation and curettage. For the abdominal approach, laparotomy postoperative orders are employed. Regardless of the approach, administer intraoperative antibiotics.

The absence of uterine involution, inflammatory changes of pregnancy, and problems with hemostasis promote better uterine healing in myomectomy than in cesarean section. Uterine rupture after myomectomy is rare in subsequent pregnancies. Brown et al reported the delivery of 120 term infants without uterine rupture; 96 were delivered vaginally and 24 by cesarean section.[4] Many obstetricians today, however, will deliver all patients after myomectomy by cesarean section except if the myoma was subserous. If the uterine cavity has been entered or multiple myomectomies performed, cesarean section is considered, by some, obligatory.[9] Others, however, feel that this concept is not valid, and vaginal delivery may be anticipated unless uterine scars have been weakened by postoperative infection. Apparently, the nongravid uterus heals better than the gravid uterus.[2]

Fertility enhancement in patients with leiomyomas and otherwise normal infertility evaluations may be minimal according to Berkeley et al.[3] In a retrospective review, 16% of patients conceived. The authors attributed this low conception rate to postoperative adhesion formation and advised close attention to the principles of infertility surgery. Babaknia et al reported a higher conception rate in patients with leiomyomata and normal infertility evaluations.[2] After myomectomy, term pregnancy rates in those patients with primary infertility approached 38%, and in those patients with secondary infertility rates approached 50%.

Myomectomy should be regarded as a temporizing procedure to gain time for reproductive efforts. Loeffler and Noble noted a 60% recurrence rate for menorrhagia and 75% recurrence of irregular bleeding in the 5-year period following myomectomy performed for these reasons.[10] The occurrence of additional leiomyomas can be expected. Brown et al found that 28% of myomectomy patients had recurrent leiomyomas in a 2-year period of follow-up, and 15% of these patients required hysterectomy.[4] Ingersoll and Malone followed a group of 125 myomectomy patients.[7] Leiomyomas recurred in 47%. When the myomectomy was performed for multiple and large tumors, the recurrence rate was 58.8%. Twenty percent of the 125 patients had subsequent hysterectomies for leiomyomas that had recurred. Likewise, Ranney reported 28.5% of myomectomy patients undergoing a hysterectomy for recurrent leiomyomas.[14]

References

1. Adhesion Study Group. Reduction of postoperative pelvic adhesions with intraperitoneal 32% dextran 70: A prospective, randomized clinical trial. *Fertil Steril* 1983; 40:612–619.

2. Babaknia A, Rock JA, Jones HW Jr: Pregnancy success following abdominal myomectomy for infertility. *Fertil Steril* 1978; 30:644–647.
3. Berkeley AS, DeCherney AH, Polan ML: Abdominal myomectomy and subsequent fertility. *Surg Gynecol Obstet* 1983; 156:319–322.
4. Brown AB, Chamberlain R, TeLinde RW: Myomectomy. *Am J Obstet Gynecol* 1956; 71:759–763.
5. Faulkner RL: The blood vessels of the myomatous uterus. *Am J Obstet Gynecol* 1944; 47:185–197.
6. Gainey HL, Keeler JE: Submucous myoma in term pregnancy. *Am J Obstet Gynecol* 1949; 58:727–737.
7. Ingersoll FM, Malone LJ: Myomectomy: An alternative to hysterectomy. *Arch Surg* 1970; 100:557–561.
8. Iosif CS, Akerlund M: Fibromyomas and uterine activity. *Acta Obstet Gynecol Scand* 1983; 62:165–167.
9. Krantz KE: Personal communication.
10. Loeffler FE, Noble AD: Myomectomy at the Chelsea Hospital for Women. *J Obstet Gynaecol Br Comm* 1970; 77:167–170.
11. Neuwirth RS: A new technique for and additional experience with hysteroscopic resection of submucous fibroids. *Am J Obstet Gynecol* 1978; 131:91–94.
12. Novak E: *Gynecological and Obstetrical Pathology,* 2nd ed. Philadelphia, Saunders, 1947.
13. Persaud V, Arjoon PD: Uterine leiomyoma. *Obstet Gynecol* 1970; 35:432–436.
14. Ranney B, Frederick I: The occasional need for myomectomy. *Obstet Gynecol* 1979; 53:437–441.
15. Rubin IC: Myomectomy in the interest of fertility. *Trans NJ Obstet Gynecol Soc* 1957; 2:7.
16. Stevenson CS: Myomectomy for improvement of fertility. *Fertil Steril* 1964; 15:367–384.

18 Surgical Correction of Uterine Anomalies

Jamil A. Fayez

It has long been recognized that malformations of the mullerian ducts can occur in several forms, ranging from a slight abnormality represented by the arcuate uterus, to the severe form represented by complete absence of the reproductive organs. Congenital anomalies of the uterus result from abnormal fusion of the mullerian ducts or from failure of absorption of the uterine septum. The actual incidence of uterine malformation is estimated to be 1.5%.[2] These uterine anomalies have been responsible in some instances for reproductive failures such as infertility, habitual abortion, premature labor, or even stillbirth at term. Because of these problems, many different operations have been used for the correction of the anomalous uterus.

Surgical correction must only be considered after ruling out other factors that might have contributed to reproductive failure. Each surgical repair should be tailored to the type of the anomaly present. Although this chapter deals only with uterine malformation, discussion of associated vaginal anomalies can hardly be avoided as the vagina is occasionally involved.

Types of Uterine Anomalies

Since uterine anomalies sometimes are associated with vaginal maldevelopment, which may or may not be obstructive to the outflow of menstrual blood, it is useful to describe these abnormalities as nonobstructive or obstructive. This classification will make the concept behind the choice of the surgical procedure for each anomaly better understood.

Nonobstructive Anomalies. According to anatomic findings, there are eight nonobstructive uterine defects. These are the arcuate, unicornuate, the partial bicornuate, the complete bicornuate, the partial septate, the complete septate, the didelphic uterus, and the diethylstilbestrol (DES) uterus.

The Arcuate Uterus. Anatomically, the arcuate uterus resembles a very mild form of bicornuate uterus (Fig. 18-1). The uterine fundal cavity has a midline curved indentation that can only be diagnosed by hysterosalpingography. The external surface of the uterus has a normal contour, and therefore the anomaly escapes detection at laparoscopy. Because of its benign nature and infrequent association with pregnancy wastage, surgery usually is not recommended.

The Unicornuate Uterus. When one mullerian duct fails to descend, the uterus and tube will be formed from the other duct, resulting in unicornuate uterus (Fig. 18-2). This defect is usually discovered when a patient is seen for infertility, as it seldom causes a clinical abnormality. As judged by reports of small series, reproduction is compromised by infertility, early pregnancy wastage, and premature labor. No surgical treatment was used to prevent fetal wastage, except cervical cerclage was recommended for patients with pregnancy wastage. Excision of the rudimentary horn, when present, was performed at the time of pelvic surgery for primary infertility with favorable results.[4]

The Bicornuate Uterus. The terms partial or complete are used depending on the extent of the median raphe (Figs. 18-3 and 18-4). Unlike the septate uterus, the bicornuate uterus causes only minimal problems with reproduction. Therefore, the distinction between these two types of uteri is of utmost importance. Hysterosalpingography does not provide a means of distinguishing septate (Figs. 18-5 and 18-6) from bicornuate uteri, and pelvic examination often is misleading. Laparoscopic study makes the critical distinction between a bicornuate and a septate uterus as it reveals a normal external contour in septate uterus versus a fundal notch in the bicornuate. Hysteroscopy also is of great diagnostic value as it clearly demonstrates the presence or absence of the septum. Urologic evaluation is recommended for patients with double uteri as there is always a possibility of a urinary tract anomaly. Reproduction in the bicornuate uterus is essentially normal, as most often the problem revolves around repeated miscarriages in a few women. It is essential in making the diagnosis of reproductive failure due to the bicornuate uterus that all possible causes of repeated miscarriages be excluded. In the absence of other causes of repeated miscarriages, patients with bicornuate uteri may benefit from corrective surgery. The Strassmann metroplasty is the only appropriate surgical treatment for symptomatic patients with bicornuate uteri.

Strassmann Metroplasty

The patient is positioned in the dorsal supine position, and the abdomen is opened by a lower abdominal transverse incision. To minimize bleeding, 10 units of vasopressin (Pitressin) diluted in 20 mL of saline should be injected into the myometrium before the transverse fundal incision is made (Fig. 18-7). The author does not pack the uterine cavity nor does he use a tourniquet around the cervix to compress the uterine vessels. Once both endometrial cavities are entered, they are stretched by fingers so that the transverse incision assumes a symmetric posteroanterior configuration (Fig. 18-8). The uterine incision is closed in two layers: the first is through the whole thickness of the myometrium using 2–0 chromic gut interrupted sutures; the sutures are tied only after all of them are in place (Fig. 18-9). While the suture is being tied, an assistant presses together the two lateral halves of the uterus with his fingers in order to relieve tension on the suture line and reduce the possibility of cutting through. The second layer is the uterine serosa approximated with interrupted 3–0 vicryl sutures placed in such a way that the knot is tied under the serosa (Fig. 18-10). At the conclusion of the procedure, a single longitudinal incision is visible.

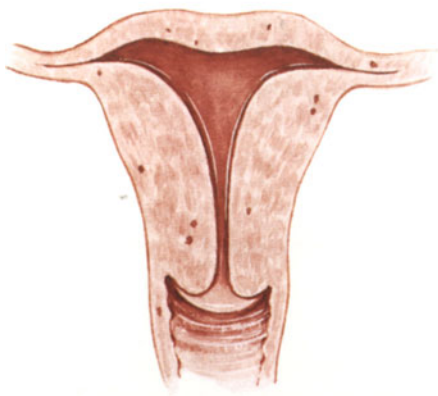


FIGURE 18-1. Arcuate defect.

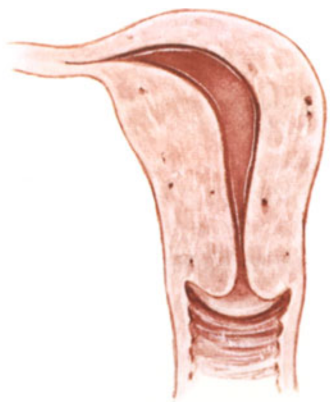


FIGURE 18-2. Unicornuate defect.

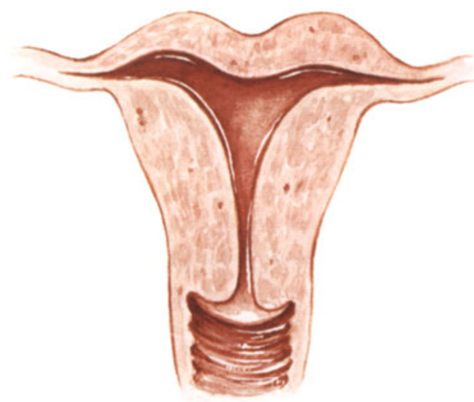


FIGURE 18-3. Partial bicornuate defect.

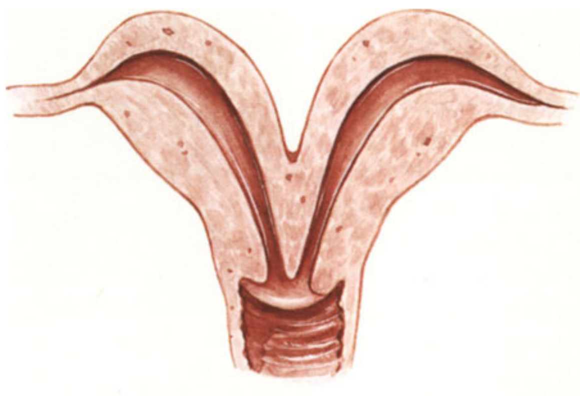


FIGURE 18-4. Complete bicornuate defect.

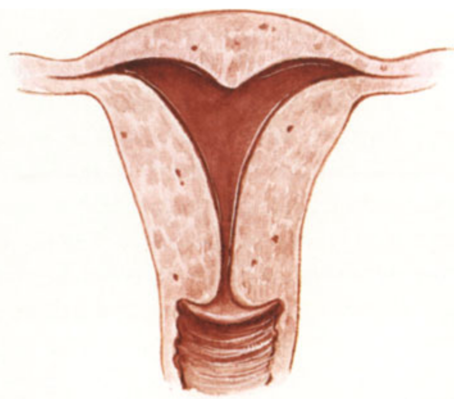


FIGURE 18-5. Partial septate defect.

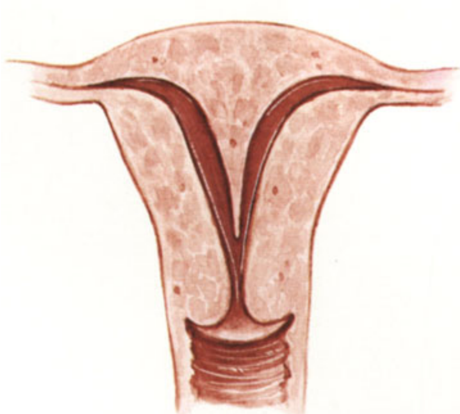


FIGURE 18-6. Complete septate defect.

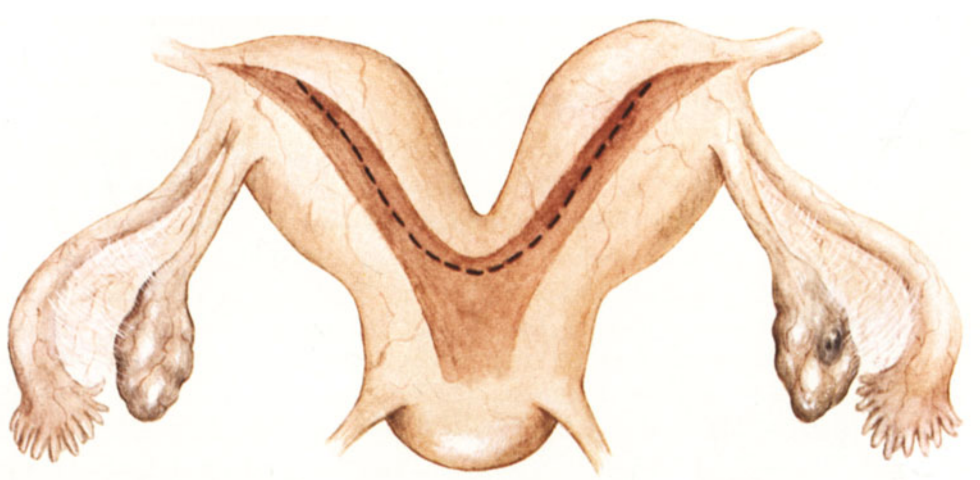


FIGURE 18-7. The dotted line shows the site of the transverse fundal incision for the Strassmann procedure.

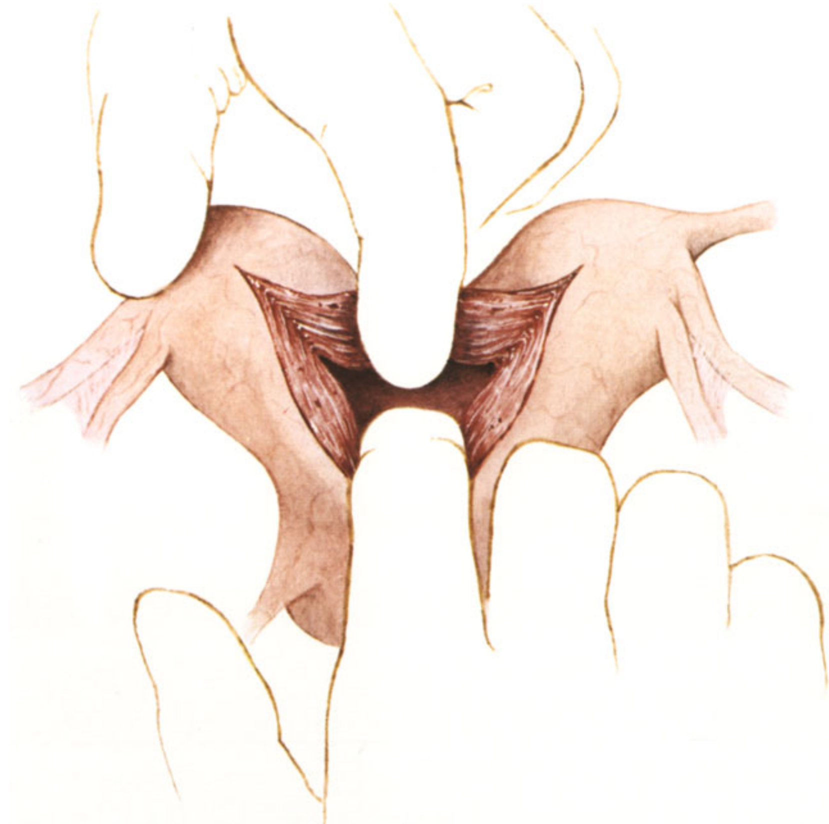


FIGURE 18-8. Stretch the incision with the fingers so that the incision assumes an anterio-posterior position.

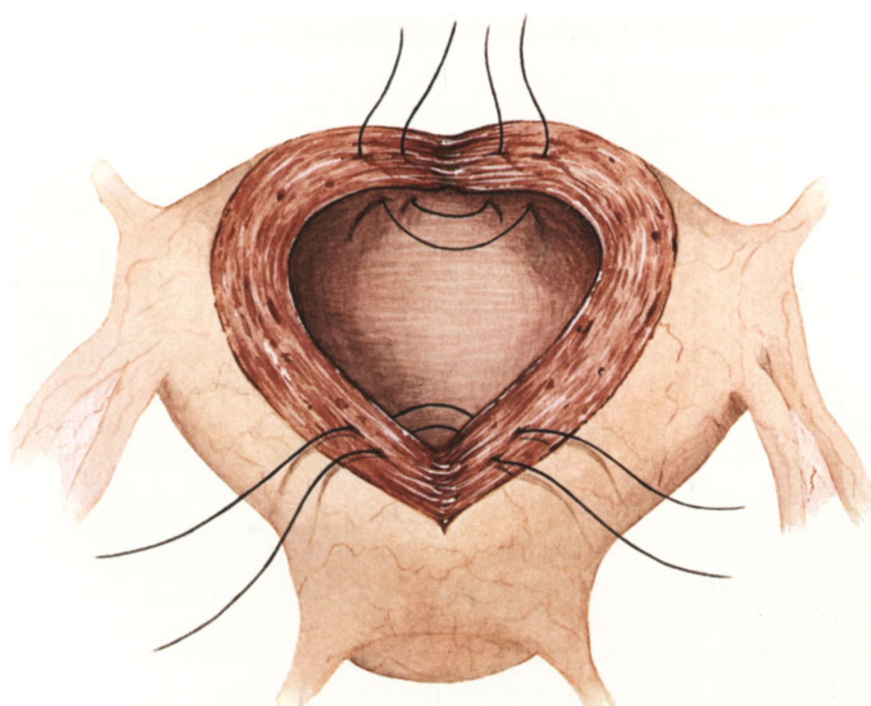


FIGURE 18-9. Place the sutures through the whole thickness of the myometrium.

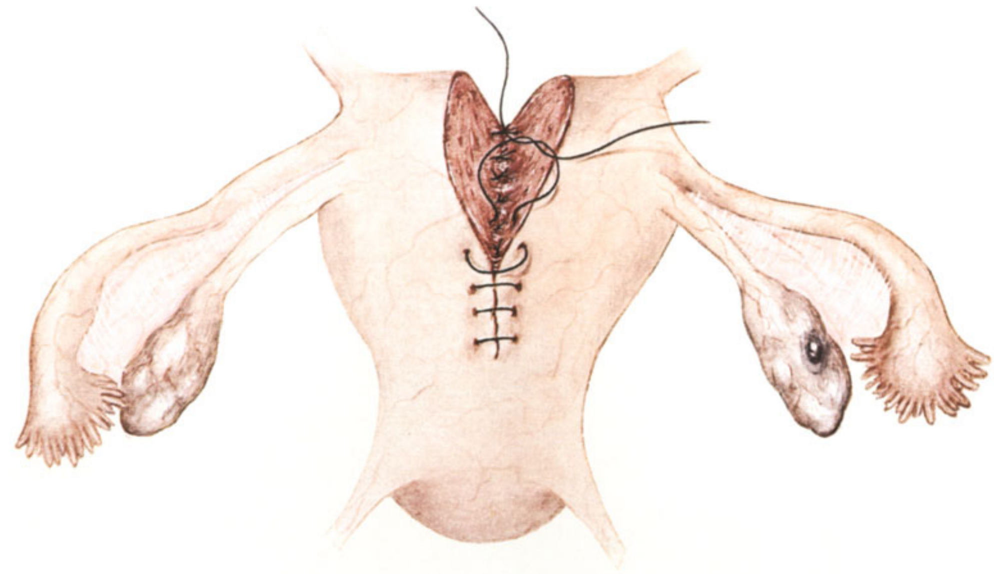


FIGURE 18-10. Place the sutures so that they approximate the serosal layer.

The Septate Uterus

Except for DES-related malformations, septate uteri are the most common uterine anomalies. If a double uterus is responsible for pregnancy wastage that requires surgical correction, it is the septate type that usually is involved. As discussed under the bicornuate uterus, all factors that may cause reproductive failure should be excluded before corrective surgery for the septate uterus is contemplated. Failure of conception rarely is an indication for metroplasty, whereas abortion and premature labor are the major indications. It has been suggested that increasing intrauterine pressure with relative cervical incompetence may be responsible for premature labor, whereas repeated abortions may be the result of the poor blood supply to the septum where nidation may occur.

Surgical correction of the septate uterus may be achieved by either the Jones wedge technique[6] or Tompkins metroplasty. Despite the fact that both procedures are equally effective with similar postsurgical results, the author favors the median bivalve technique of Tompkins because it has the advantage of not requiring excision of uterine tissue and thus not reducing the potential uterine space. Recently we have been excising the uterine septum via the hysteroscope. Hysteroscopic incision of the septum gives equally satisfactory results; it is a simple procedure with less trauma, and, most importantly, it preserves the potential for vaginal delivery. Excision of the septum increases the fetal salvage rate from 24% to 90%.[1]

Tompkins Metroplasty

The patient is positioned in the dorsal supine position and the abdomen is opened by a Pfannenstiel incision. To control blood loss 10 units of vasopressin diluted in 20 mL of saline should be injected into the myometrium along the incision line, which starts in the midline of the fundus, extending through the whole thickness of the myometrium, and proceeds along the midline of the anterior and posterior walls of the uterus (Fig. 18-11). The septum, being median, is bisected as one cuts down through the uterus. The incision should

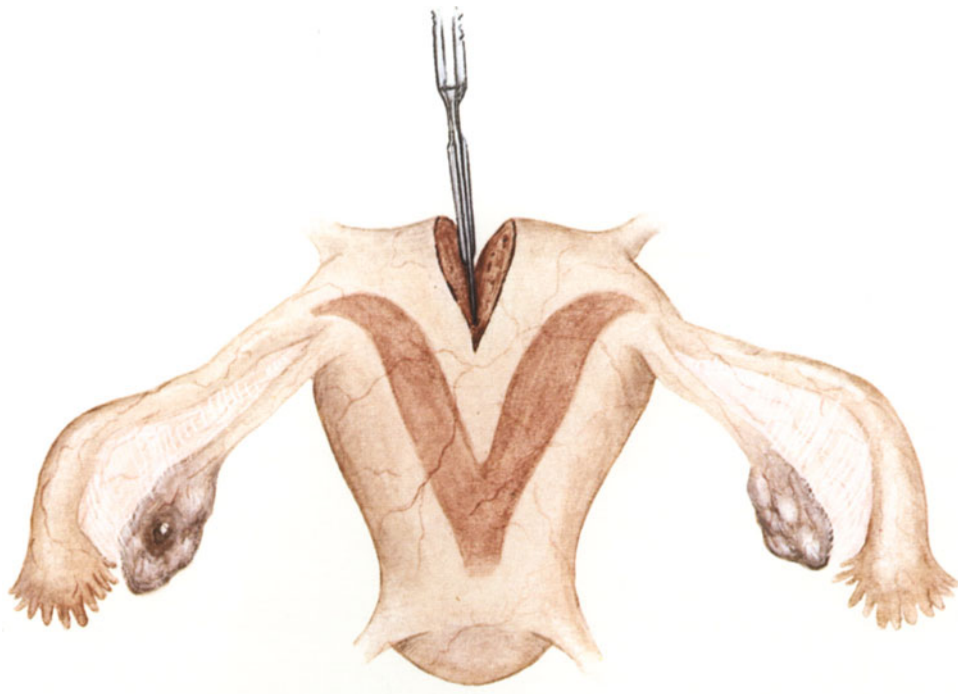


FIGURE 18-11. The incision lines for the Tompkins metroplasty.

be extended beyond the inferior margin of the septum to expose the endometrial cavity of each side. In case the septum is complete and extends to the level of the cervix, the incision should be extended until the narrow lower portion of the uterus is reached. Once the endometrial cavity is entered, the blades of a Kelly clamp are inserted into each cavity upward toward the cornua, and the septum is incised bilaterally along the clamp without excising it (Fig. 18-12). Excision of the cervical septum does not cause incompetent os. As the septum is cut, the muscle retracts and the uterine cavity on that side is unroofed. Unless the septum is very thick, there is no need to perform any trimming before beginning reconstruction. The uterine cavity is closed with

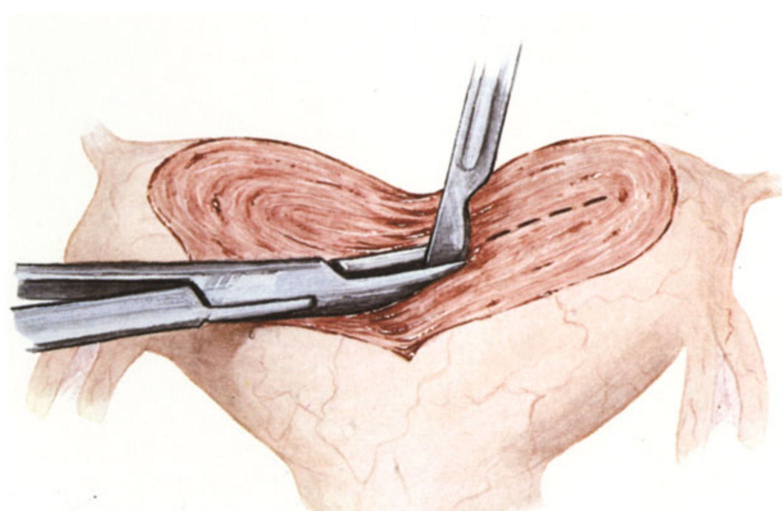


FIGURE 18-12. Incising the septum of the uterine septum along a Kelly clamp.

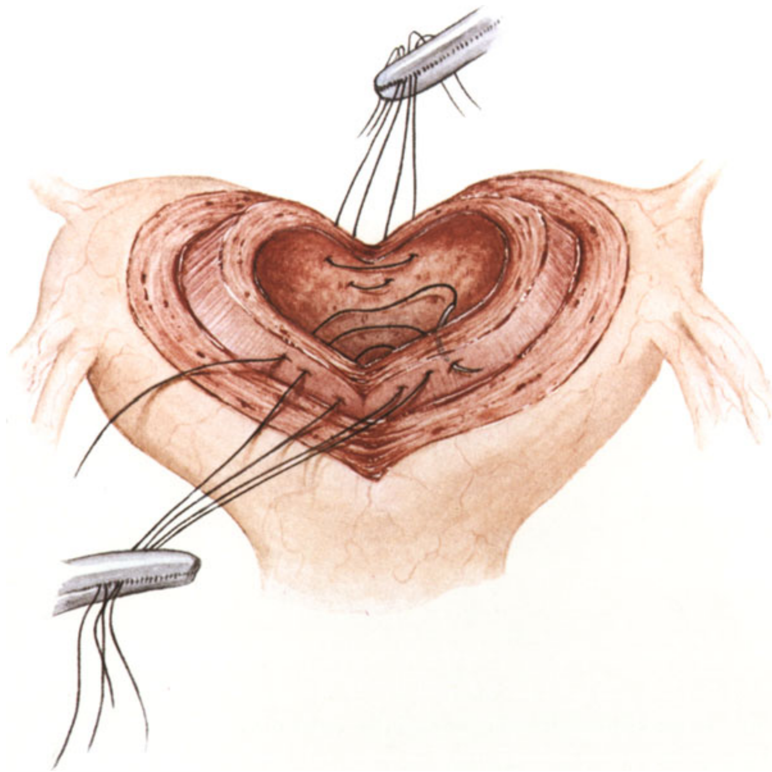


FIGURE 18-13. Sutures closing the anterior and posterior uterine walls.

2–0 chromic gut interrupted sutures through the myometrium. The sutures are placed on the anterior and posterior aspects of the uterus about 1 cm apart; none should be tied until all sutures are in place (Fig. 18-13). The uterine serosa is approximated with interrupted sutures of 3–0 vicryl placed in such a way that the knot is buried under the serosa (Fig. 18-14).

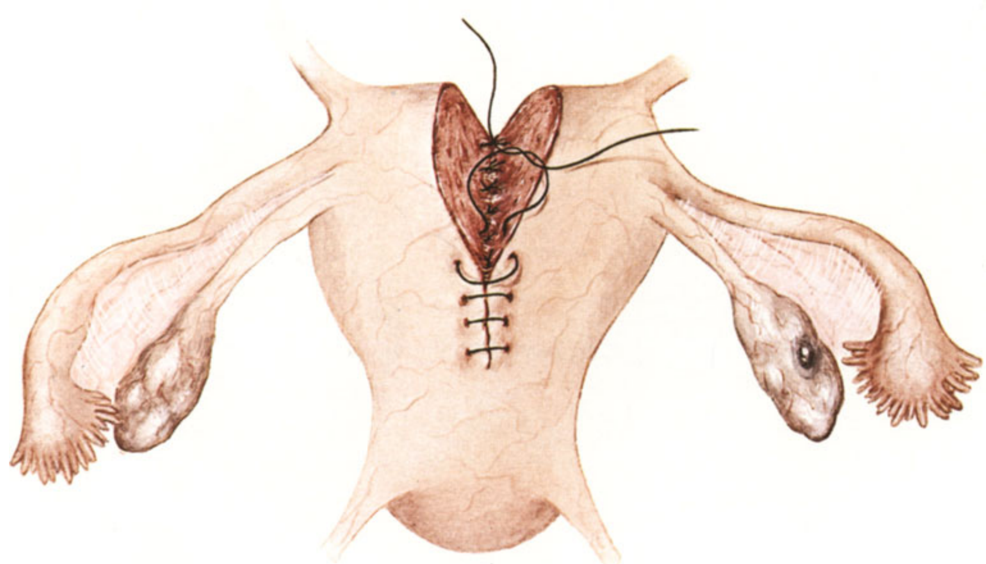


FIGURE 18-14. Place the sutures so that they approximate the serosal layer.

Patient's Follow-up

The night before surgery, 200 mg of doxycycline is given to the patient by mouth. Just prior to surgery, 100 mg doxycycline is given intravenously and the same dose is repeated 12 hours later. Doxycycline is then given as 100 mg twice daily by mouth for five postoperative days. To prevent the formation of adhesions to the uterine incision, 300 cc of Ringer's lactate solution is instilled into the cul-de-sac before abdominal wall closure. Patients are generally discharged from the hospital on the second or third postoperative days. Estrogen is not given postoperatively, and no intrauterine device or catheter is used to prevent intrauterine synechiae.

Barrier contraception is recommended during the first 3 months after operation to allow the uterine incision the best possible opportunity to heal. The use of oral contraceptives is not advised because of the progestational effect on the myometrium and the possibility that healing would be less firm. Despite the fact that vaginal delivery is possible, the author recommends that all women who had abdominal metroplasty be delivered by cesarean section to avoid the minimal chance of a uterine rupture.

The Uterus Didelphys

The didelphic uterus is the result of the failure of lateral fusion involving the uterus, cervix, and vagina (Fig. 18-15). Unless there is an obstruction, there should be no symptoms related to menstruation. However, dyspareunia may be a problem owing to the narrowness of the vagina. Reproduction failure in the form of abortions or premature labor is not unusual in patients with didelphic uteri.

Surgical correction of a didelphic uterus is not feasible with a modified Strassmann procedure, and cervical cerclage was suggested but never documented.[3] Excision of a vaginal septum that might cause dyspareunia is not particularly difficult. A Kelly clamp is applied to each pole of the septum attached to the anterior and posterior wall of the vagina and the septum excised between the two clamps. Usually bleeding is minimal and no suturing is required. If the septum is very thick and contains a large number of blood vessels, hemostasis can be easily achieved by the use of 0-chromic gut sutures, taking extra care not to involve the bladder or rectum.

The DES Uterus

Since the early seventies the most commonly observed uterine anomalies are those that are DES-induced (Fig. 18-16). The types of anomalies reported included the T-shaped uterus with a small cavity, the T-shaped, the small cavity, the T-shaped and small cavity with constrictions, T-shaped with constrictions and other rare anomalies.[5] About 60% of DES-exposed women are able to carry pregnancy to term, 20% fail to conceive, and the remaining 20% have repeated miscarriages.

No surgical procedure has been recommended that can correct the major uterine abnormalities to allow for a viable pregnancy. Hysteroscopy is highly recommended by the author as it may help excising congenital uterine synechiae. For repeated miscarriages, cervical cerclage is most likely to be effective.

Obstructive Anomalies of the Vagina and Uterus

Lateral fusion disorders of the mullerian ducts may result in partial or complete duplication of the vagina or uterus. This lateral duplication may result in

FIGURE 18-15. Didelphic uterus.

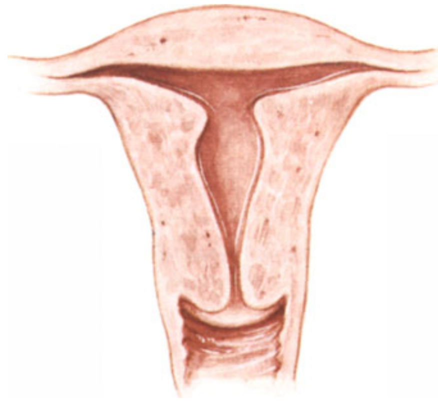


FIGURE 18-16. DES uterus.

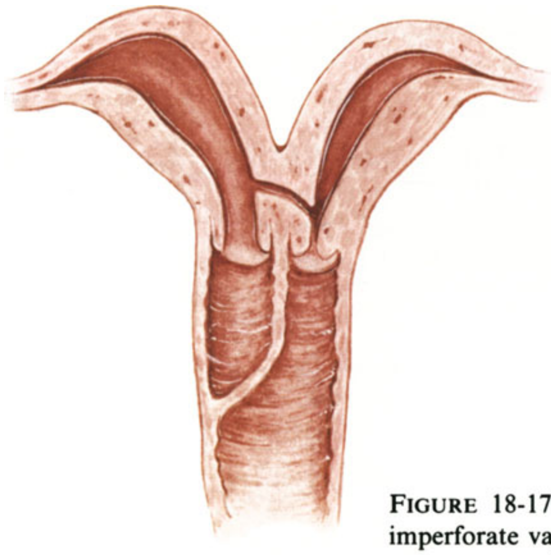


FIGURE 18-17. Uterus didelphys with unilateral imperforate vagina.

obstruction in the vagina or uterus due to failure of the lumen to communicate with the outside. Signs and symptoms are consistently related to the site of obstruction.

Uterus Didelphys with Unilateral Imperforate Vagina

The unilateral imperforate vagina in uterus didelphys (Fig. 18-17) will result in symptomatic ipsilateral accumulation of menstrual blood, causing monthly dysmenorrhea. The presence of a paravaginal cystic mass, which increases in size during menses, the absence of a kidney on the affected side, and increasing dysmenorrhea since menarche are frequent characteristic findings in patients with this condition. If the condition goes unrecognized for a number of years, hematocolpos, hematometra, hematosalpinx, and endometriosis may develop and render the patient sterile.

If the unilateral vaginal obstruction is associated with a lateral communication between the two horns of the uterus, usually through the cervix, then the obstructive symptoms are generally less prominent. Such a patient usually complains of vaginal mass during menstruation that gradually disappears when flow ceases. Intermenstrual vaginal discharge is also a frequent complaint.

Once the diagnosis has been made, excision of the vaginal septum should be contemplated. During septum excision, the bladder should be empty to prevent injury. Instillation of 25 mL of methylene blue into the bladder facilitates early detection of bladder injury. Patients who are properly diagnosed and treated should be free of symptoms and have an intact reproductive tract.

At times the obstruction occurs in the region of the cervix or of the uterus. Anastomosing the obstructed cervix to the unobstructed side vaginally usually solves the problem. When the obstruction is caused by an isolated functional horn, excision of the horn is mandatory to prevent retrograde menstruation, which may cause endometriosis.

Intravenous pyelography for patients with didelphic uteri associated with unilateral obstruction is diagnostic as the ipsilateral kidney is always absent.

References

1. Buttram VC, Gibbson WE: Mullerian anomalies: A proposed classification. *Fertil Steril* 1979; 32:40–46.
2. Dunselman GAJ: *Congenital malformations of the uterus. Results of the Strassmann metroplastic operation.* Holland, NV Helmond, 1959.
3. Gross A, David A, Serr DM: Management of congenital malformations of the uterus: Fetal salvage. *Acta Eur Fertil* 1974; 5:301–305.
4. Jones HW: Reproductive impairment and the malformed uterus. *Fertil Steril* 1981; 36:137–148.
5. Kauffman RH, Adam E, Binder GL, et al: Upper genital tract changes and pregnancy outcome in offsprings exposed in utero to diethyl-stilbestrol. *Am J Obstet Gynecol* 1980; 137:299–308.
6. Rock JA, Jones HW: The clinical management of the double uterus. *Fertil Steril* 1977; 28:798–806.

19 Fallopian Tube

Marvin A. Yussman

The rekindled interest in tubal surgery within the past 15 years is due to several factors. The fascination with the technical capabilities provided by the operating microscope and the array of unique microsurgical instruments certainly are high among them. There are, however, other important factors. Sterilization has become the most common method of contraception in women over age 28 years. This has dramatically increased the request for reversal of sterilization because of remarriage or a child's death. The rate of venereal disease has risen rapidly since the early 1970s. Each new case of salpingitis is reported to result in a 15% probability of tubal obstruction.[7] This increase in case load combined with improved technical capacity has significantly increased the number of attempts to correct damaged fallopian tubes.

The initial reports of the use of the operating microscope in gynecologic surgery appeared in the Scandinavian literature in the mid-1960s.[6] After a slow start, microsurgery has become the most acceptable method of repairing damaged fallopian tubes. There is currently, however, no convincing evidence that the operating microscope increases the incidence of pregnancy following repair of chronic adnexal adhesive disease. In fact, when used by inexperienced surgeons, the microscope is an obvious hindrance. With proper training, one finds the operating microscope valuable in providing excellent illumination to the operating field. It provides a better depth of field and a wider field of vision than operating loops. Under magnification, otherwise obscure dissection planes become evident, decreasing disruption of normal tissue. Bleeding can be controlled with minimal damage to surrounding structures. With experience, the operating microscope is a valuable adjunct to the gynecologic surgeon. Reanastomosis of previously ligated fallopian tubes is the only procedure that is improved statistically when performed using the operating microscope.

The table for operating microscopy should allow the surgeon to sit comfortably with the forearms at the level of the abdominal incision. This is best achieved with a custom-designed table. A standard operating room table can be adapted for microsurgery by using an x-ray extension arm which allows the patient's lower abdomen to be moved beyond the center pedestal. The operating microscope is positioned at the distal corner of the operating table. The surgeon and assistant make all necessary optical adjustments after the patient is anesthetized but before scrubbing. A No. 8 pediatric Foley catheter with a 5-cc bag is placed in the endometrial cavity. An extension set is run from this catheter to allow later the injection of indigo carmine dye by the operating surgeon (not by an assistant away from the field). Some surgeons pack the vagina to lift the pelvic structures. The author has abandoned this procedure, having found the vaginal pack frequently a hindrance to exposure. The abdominal cavity is usually entered through a Pfannensteil incision, though this may be altered if there is a previous abdominal scar or if one anticipates extensive dissection of bowel. The adnexa are brought as high into the incision as possible to make best use of the operating microscope. The structures may be elevated with a silastic shield, although the author has found it clumsy. An alternative is to elevate the structures with laparotomy packs that have been thoroughly soaked in heparinized Ringer's lactate solution. Several packs placed in the cul-de-sac will elevate the adnexa upward, and one pack placed between the uterus and the symphysis usually will fix the pelvic structures in the midplane of the incision for easy access. Packing of bowel usually is unnecessary.

General principles of microsurgery should be followed when doing tubal surgery whether or not an operating microscope or other form of magnification is used. These principles include the following.

1. Handle tissues with the most delicate instruments that will accomplish the task.
2. Keep the operative field moistened at all times with heparinized Ringer's lactate solution.
3. Avoid tension on tissue which results in ischemia.
4. Use the finest suture material and needle compatible with the task to be accomplished.
5. Avoid sponging. Use jets of lactated Ringer's to expose bleeding points.
6. Use bipolar coagulation to control the source of bleeding.
7. Obtain complete hemostasis to prevent disruption of suture lines.
8. Use stay sutures to bring tissues to be approximated into apposition with the least possible tension.

Preoperative Evaluation

The purpose of tubal repair is to achieve pregnancy. Reparative procedures on the fallopian tube for other reasons, as relief of chronic pain following chronic pelvic inflammatory disease, will not likely achieve the desired result. Therefore, preoperative evaluation for tubal repair must be divided into two categories. The first is the evaluation common to all patients undergoing surgery. This general preoperative evaluation is detailed in Chapter 5. The second area of evaluation is specific for patients undergoing tubal repair. This is an effort to assess the prognosis for pregnancy.

Women reach their maximum fertility potential in their midtwenties. By age 27 the fertility potential begins to decline. By age 35, only half of the women attempting pregnancy are able to conceive.[1] The incidence of age-related genetic defects should also be considered. Table 19-1 shows the relation of age to genetic defect. All women beyond age 35 should be aware of the advisability of amniocentesis following conception.[3]

A semen analysis should be performed on the sexual partner. A poor semen analysis is not a contraindication to tubal repair. However, the decreased prognosis for pregnancy should be communicated to the couple. A hysterosalpingogram (HSG) should be obtained. This is not obviated by laparoscopy. The hysterosalpingogram enables assessment of intrauterine defects that remain unobserved during laparoscopic examination. In addition, the HSG can

TABLE 19-1. Incidence of All Fetal Genetic Abnormalities by Maternal Age

Maternal Age	Incidence of All Genetic Abnormalities
33	.34%
35	.51%
37	.78%
39	1.21%
41	1.91%
43	3.02%
45	4.83%

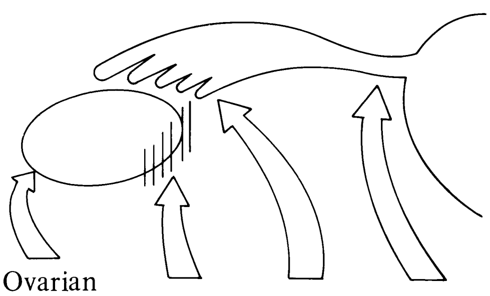
assess the patency of what may appear to be a normal proximal tube following a sterilization procedure. The lack of patency may suggest that a reimplant rather than a reanastomosis would be a more fruitful procedure. In assessing chronic adnexal adhesive disease, the HSG can establish patency to the point of the externally observed distal occlusion. The demonstration of proximal occlusion in addition to the observed distal disease indicates a very poor prognosis. The demonstration of plical folds in the ampulla of the tube following evacuation of the dye indicates that there is little intraluminal destruction and suggests a more favorable prognosis.

Laparoscopy should be performed prior to tubal repair. In assessing tubes for reanastomosis, one should observe the length (or absence) of the proximal tube. If the proximal tube is absent, the possible requirement for a tubal reimplantation and subsequent cesarean section should be discussed with the patient. One also uses the laparoscope to measure the distal tube in order to plan the subsequent repair and to give the patient a prognosis for pregnancy. Prognosis following various types of repair are given in Table 19-2. The damage and resulting adhesions of the ovary and fimbria caused by the original sterilization can be assessed and used to assess a prognosis. The length of fallopian tube following the repair is one of the most important prognostic indicators. The pregnancy rate with greater than 5 cm of fallopian tube should be well in excess of 60%.[2] Pregnancy rates with less than 4 cm of tube fall off rapidly. There is serious question if reanastomosis should be performed if there is less than 3 cm of tube available, as the pregnancy rate with in vitro fertilization and embryo transfer is higher.

In assessing possible repair of chronic adnexal adhesive disease, the laparoscope is used to classify the extent of the damage according to a system suggested by the American Fertility Society. That classification and prognosis are presented in Figure 19-1.

TABLE 19-2. Pregnancy Rate by Site of Anastomosis

Site of Anastomosis	Pregnancy Rate (%)
Isthmus-isthmus	65–85
Isthmus-ampulla	65–70
Ampulla-ampulla	65–70
Isthmus-cornu	0–45
Ampulla-cornu	0–15



	Ovarian Surface	Adhesions	Fimbria	Isthmus
Normal	( ) 100% seen	( ) None	( ) Open	( ) Open
30-50% Prognosis	I over 50%	A Thin	F Closed	i Closed
Poor Prognosis	II under 50%	B Thick		

FIGURE 19-1. Staging of adnexal adhesive disease. Four independent observations are made on each of the adnexa. Poor prognoses are associated with extensive or thick adhesions or with combinations of adhesions and tubal obstruction. After laparotomy for correction of adhesive disease, the following patient classification conventions apply. (1) Revise staging after laparotomy, e.g., fimbrial occlusion due to adhesions around patent fimbria would be staged IAF at laparoscopy but would be revised to IA since no salpingostomy was required at laparotomy. (2) Classify patient according to most favorable adnexa, e.g., a patient staged as IIAF-IIA after laparotomy would be classified IIA for prognostic purposes. (From: Hulka J.F., *Am J Obstet Gynecol* 1982; 144:141.)

Ampullary-Isthmic Reanastomosis

Opening the ampullary portion of the fallopian tube allows its luxuriant mucosa to protrude. This voluminous, highly vascular tissue interferes with the proper anastomosis of this region of the fallopian tube to the more muscular isthmic region.

There are three ways of handling the ampullary portion of the fallopian tube during an isthmic-ampullary anastomosis.

Procedure #1

One of a variety of specially designed probes is carefully introduced through the ostium of the tube. These instruments should slide easily through the tubal lumen and distend the occluded portion of the tube. They should also have a mechanism to guide a stent back from the occluded end through the ostium. The simplest of such instruments may be a long straight Keith needle. A lacrimal duct probe with a hole drilled in the end works well. An instrument distributed by S & T Instruments* is specially designed for this purpose. Basically, it is a grooved probe. The groove allows the stent to be guided through the tube. The fallopian tube is held with the fingers rather than with an instrument in order to minimize trauma. The ostium is clearly identified and the probe introduced. The probe is allowed to tent outward the occluded portion of the tube. The tented portion is grasped by a fine-toothed

* Accurate Surgical and Scientific Instruments Corporation (ASSI), 300 Shames Drive, Westbury, NY 11590.

forceps. A Pierce tissue forceps is ideal for this (Fig. 19-2). The probe is then slightly withdrawn. This maneuver allows the forceps to continue to grasp the serosa of the tube while allowing the muscularis and the mucosa to retract along with the slightly withdrawn probe. An iris scissors is then used to snip the bit of mucosa held by the Pierce forceps (Fig. 19-3). This creates a circle of excised mucosa with an intact muscle layer exposed. The size of the circle excised is gauged by the size of the proximal tube to which it will be anastomosed. Bleeding points at the edge of the excised serosal surface are cauterized with a bipolar cautery. Vessels visible on the exposed underlying muscularis may also be cauterized at this time (Fig. 19-4).

The probe is pushed forward once again. This now tents the muscularis, which is grasped by a fine-toothed forceps in the manner that the serosa had been held previously (Fig. 19-5). The tented muscularis is snipped with an iris scissors (Fig. 19-6). This should be done so that less muscularis than serosa is removed. The result of this series of maneuvers is to have concentric open circles of serosa and muscularis. The mucosa usually remains intact as the result of scarring from the original sterilization procedure. Bleeding points on the muscularis are coagulated with the bipolar coagulating forceps. The mucosa is now examined. If there is evident scarring, the mucosa is pushed forward with the intraluminal probe. Vessels are identified and coagulated following which an opening is dissected. Usually the probe can be used to dissect free the few remaining adhesions. The result is the fenestrated probe protruding through the previously occluded portion of the ampulla. The probe is surrounded by clearly delineated concentric layers of mucosa, muscularis, and serosa (Fig. 19-7). The stent is threaded into the probe's fenestration and drawn through the tubal lumen leaving the stent protruding a good distance beyond each end. A difficulty with this technique is that the opening created is frequently at the superior portion of the occluded end, leaving a dependent inferior sac. It has been the author's concern that the dependent sac is a possible source for a subsequent ectopic pregnancy. However, the rate of ectopic pregnancy has not been reported higher in tubes prepared in this manner.

The occluded end of the isthmic portion of the fallopian tube is opened more directly. After carefully dissecting the tube free from the surrounding fibrous tissue, all bleeding points created by the dissection are controlled with bipolar coagulation. The occluded end of the tube is grasped with a fine-toothed forceps and amputated (Fig. 19-8). The mucosa of the isthmic portion presents no problem because it is so scant. The serosa retracts, leaving clearly defined tissue layers. Most bleeding is subserosal and easily controlled by raising the serosa and identifying the source with jets of heparinized Ringer's lactate solution delivered through a syringe equipped with a 25- or 26-gauge needle.

The stent from the ampullary portion of the tube is carefully guided into the proximal tube. Curling of the stent within the tube is prevented by grasping the serosa of the tube and stretching it while feeding in the stent.

The mesosalpinx beneath the proximal and distal tubes are approximated with 4–0 Prolene, nylon, or Vicryl. The purpose of this suture is to approximate the edges to be anastomosed and to relieve tension on the anastomotic site (Fig. 19-9). It may be necessary to replace this suture several times to obtain an accurate approximation—one that relieves tension but does not distort the tube.

The muscularis of the isthmus is then anastomosed to muscularis of the ampulla. The 6 o'clock suture is placed first as it would be virtually impossible to place later (Fig. 19-10). Many authors insist that sutures not enter the

FIGURE 19-2. Serosa of occluded segment of ampullary fallopian tube is grasped by toothed forceps in preparation for amputation.

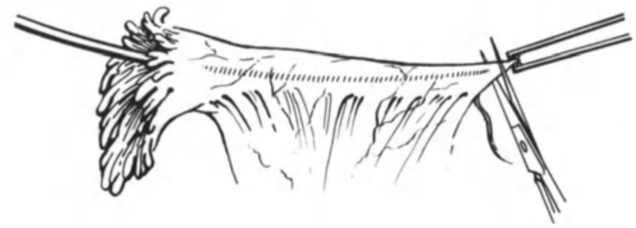
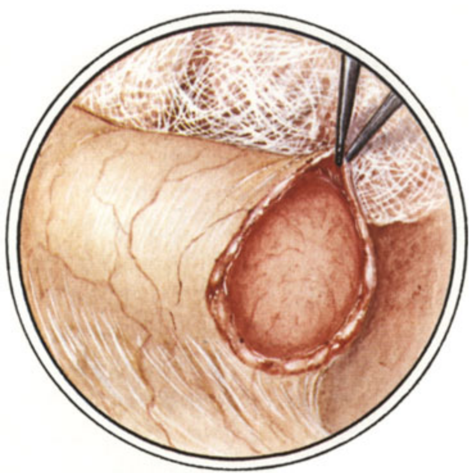


FIGURE 19-3. Serosa of ampullary portion of fallopian tube is excised. Note retracted probe and muscularis.



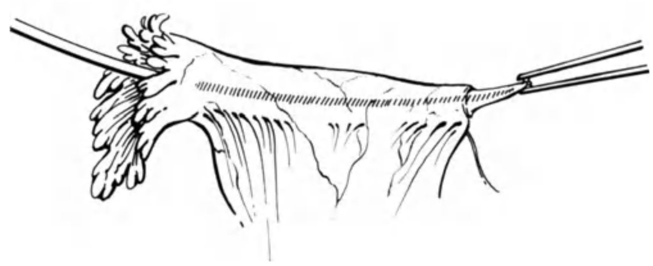


FIGURE 19-5. Muscularis of fallopian tube is exposed with an intraluminal probe and grasped with a toothed forceps.

◁ FIGURE 19-4. The serosa of the ampullary portion of fallopian tube has been excised, exposing the intact muscularis. Subserosal bleeders are coagulated with bipolar coagulator.

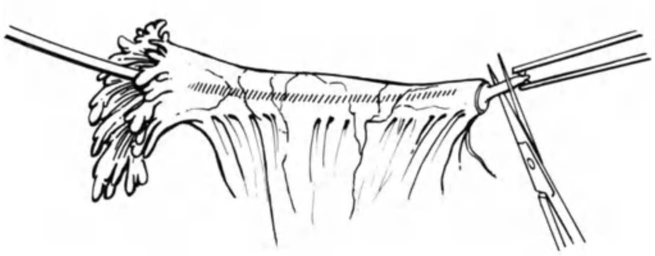


FIGURE 19-6. The serosa has been excised. The probe has been retracted and muscularis grasped and excised.

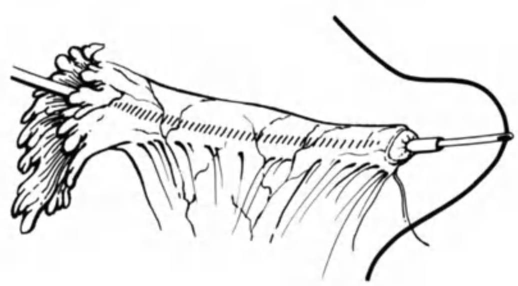


FIGURE 19-7. A fenestrated probe penetrates all layers. A stent is in place in preparation for being drawn through the fimbriated end of fallopian tube.

lumen of the tube. However, the theoretical objection of increased intraluminal fibrosis is not substantiated. The intraluminal suture may, in fact, assure continuing luminal alignment after withdrawal of the stent. The suture should be the smallest material that the surgeon can handle with confidence. The author prefers 9–0 nylon. Suture as large as 6–0 has been used with success. The remaining sutures to anastomose the muscularis are now placed. Generally, sutures placed at the 6, 12, 3, and 9 o'clock positions are adequate (Fig. 19-11). However, this must be judged individually, based on the size of the opening to be approximated. After the muscularis is closed, the stent is removed and indigo carmine dye injected through a previously placed intrauterine catheter. Ideally, the anastomosis is water tight and the dye spills freely from the fimbriated end. It is, however, not essential that the operating site be water tight. If there is free spill of dye from the fimbria, efforts to occlude a minor amount of leakage is likely to create disruption. Occasionally, gross leakage of dye can be observed at the anastomosis and no dye spills from the fimbriated end. Usually this indicates that one of the sutures has come loose and needs to be replaced. If this is not the case, finding and repairing the leakage can be most frustrating. It is less time consuming to take down the anastomosis and reapproximate the ends again rather than spend a long, frustrating time searching for a major leak. The most likely spot for a poorly placed suture is the original 6 o'clock position. When satisfied that the muscularis is closed properly, the serosa is approximated with a series of 8–0 or 9–0 interrupted sutures (Fig. 19-12).

Procedure #2

To avert the dependent sac created by the previously described technique, an alternative technique may be used. A probe is introduced through the fimbria as in the previous technique. The occluded portion of the ampullary tube is dissected completely from the surrounding area of fibrosis and from the mesosalpinx. The assistant keeps constant tension on the occluded area of the tube with the probe. An iris scissors is used to dissect a circle of serosa around the protruding tube (Fig. 19-13). The circle should be judged to be approximately the size of the proximal tube to which it will be attached. After the circle is incised, it usually can be stripped with ease, using forceps and a few judicious snips with an iris scissors. The subserosal bleeding is controlled with a bipolar coagulating forceps. The exposed circle of muscularis is grasped at its center with a toothed forceps and elevated. This cone is excised with an iris scissors (Fig. 19-14). Great care must be taken not to make the opening too large, as the profuse mucosa will exude, creating a most frustrating attempt to return it. The fenestrated probe is dissected through the mucosa and the muscularis opening. The stent is threaded into the probe's fenestration or groove, following which it is brought through the fimbriated opening. The remainder of the anastomosis is completed in the manner described previously. This technique is the author's preference, acknowledging the difficulty occasionally created by the protruding mucosa.

Procedure #3

When there is ample isthmic fallopian tube but a scant amount of ampullary tube, a different strategy must be employed. A very small segment of fimbria will not allow dissection of layers. Under these circumstances the proximal isthmic portion of the tube is prepared differently. The end of the segment is freely mobilized. The serosa is stripped from the underlying muscularis for a distance of 0.5 to 1.0 cm. The occluded end is amputated, following which the lumen is identified and cannulated.

The fragment of ampullary tube is threaded over a large diameter lacrimal duct probe. The occluded portion is dissected open; bleeding points are ligated. The result frequently is a mass protrusion of the mucosa and retraction of the serosa. The large probe is kept in place to keep the lumen patent and

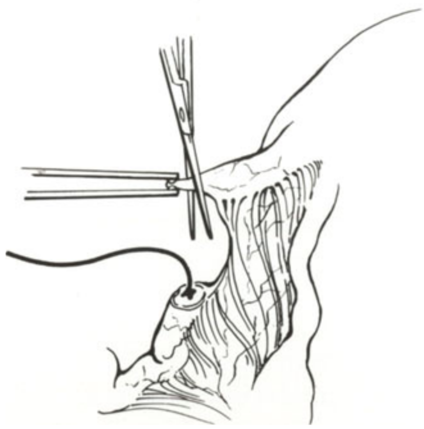


FIGURE 19-8. The stent occupies the distal end of the fallopian tube. The occluded proximal portion of the isthmus is incised through all layers.

FIGURE 19-9. The lumen has been identified in the proximal and distal segments of the fallopian tube. The stent is in place. A stay suture is placed through the proximal and distal mesosalpinx.

FIGURE 19-10. The mesosalpinx beneath proximal and distal portions of fallopian tube has been reapproximated. The initial 6 o'clock stay suture has been placed.

FIGURE 19-11. The muscularis has been approximated by a series of interrupted sutures.

FIGURE 19-12. The finished reanastomosis is accomplished by a series of interrupted sutures approximating the serosa of the fallopian tube.

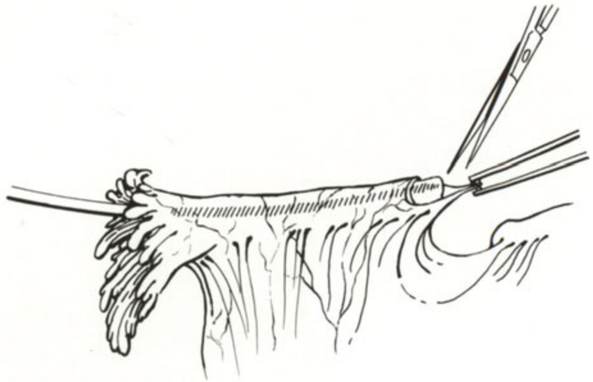


FIGURE 19-13. The serosa has been tented forward and excised, exposing the underlying muscularis.

the surgeon oriented. A 6–0 or 7–0 nylon suture is introduced through all layers of the distal tube and is guided out the newly dissected opening using the probe as a guide. The suture is used to take a substantial bite into the end of the isthmic muscularis (Fig. 19-15). The needle is then guided back into the lumen of the ampulla and exited at a point near the suture's original entrance. Two additional sutures are similarly placed equidistant around the tube. While an assistant holds the cut ends of the ampulla with fine forceps, the pairs of sutures are drawn together, bringing the prepared isthmic tube into the lumen of the ampulla. When the isthmus has been totally invaginated, each of the three pairs of sutures is tied together. This creates an "arm in sleeve" approximation (Fig. 19-16). The serosal edges are approximated with a series of 9–0 sutures, and the stent is removed.

Indigo carmine dye, introduced through the intrauterine catheter, should flow freely through the opening. Failure to do so indicates that the muscularis of the isthmus does not, in fact, occupy its space within the lumen of the ampulla.

Isthmic-Isthmic Reanastomosis

Anastomosis of the isthmus to the isthmic portion of the fallopian tube is the easiest of the tubal reanastomoses. This situation is most commonly encountered when the sterilization has been done by rings, clips, or by judicious bipolar coagulation.

The proximal fallopian tube segment should be carefully but completely freed from the fibrosis and mesosalpinx surrounding it. Bleeding created by dissecting down the mesosalpinx should be carefully controlled with bipolar coagulation. When the occluded end of the tube is freely mobilized, the most distal portion is grasped with a toothed forceps. Approximately 0.3 to 0.5 mm of tube is amputated. Under adequate magnification the lumen should be obvious. The lumen can be cannulated immediately with a 3–0 suture. After cannulation, bleeding points are controlled with bipolar coagulation. There is usually one substantial bleeder from the vascular arcade at the 6 o'clock position. The remainder of the bleeders are usually minute and create little problem. It is important to examine the mucosa under high power to assure that there is good pink color and free plicae. Observing a white, firm, fibrous mucosa, even though patent, is an indication to remove a further segment of the tube. Cannulation of the tube is facilitated by grasping the serosa with a fine toothed forceps and stretching it while the stent is fed toward the uterus.

The occluded portion of the distal fallopian tube is then mobilized. It is not advisable to place a probe into the isthmic portion of the tube as was recommended for the ampullary portion. The luminal diameter is approximately 0.5 mm and narrows rapidly at the isthmic ampullary junction. The chances of damaging the mucosa at this point are great. It is most advisable to treat this distal end in the same manner as the proximal end. That is, it is mobilized and grasped at its occluded portion. The occluded end is amputated. The free portion of the stent is fed into the opening. One should not expect to retrieve the stent from the fimbrial orifice. The stent will be removed at the anastomotic site just before tying the last muscularis suture.

When the stent is in each opening and bleeding controlled, a stay suture of 4–0 or 5–0 permanent monofilament suture is placed in the mesosalpinx immediately below each end. This suture approximates the ends for easy anastomosis and relieves tension on the suture line. It is necessary that this suture be placed to bring the ends together without kinking or otherwise distorting them. It may take several efforts to place this suture satisfactorily.

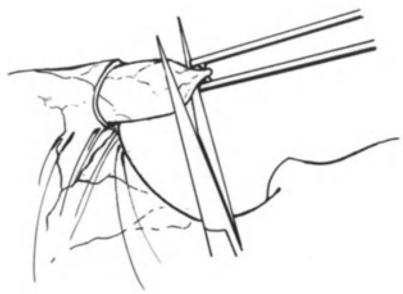


FIGURE 19-14. The muscularis of the occluded portion of the ampullary portion is excised.

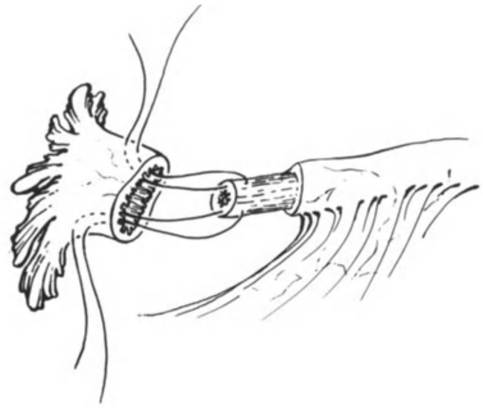


FIGURE 19-15. The serosa of the proximal fallopian tube has been excised, exposing a long segment of muscularis. The lumen is clearly delineated. The occluded portion of the ampulla is open. Sutures have been placed for the purpose of invaginating the proximal fallopian tube into the lumen of the ampulla.

FIGURE 19-16. The proximal tube has been invaginated into the remaining distal segment of fallopian tube. This has been fixed by sutures previously placed through all layers of the ampulla. The serosa is approximated with a series of 9–0 nylon sutures.

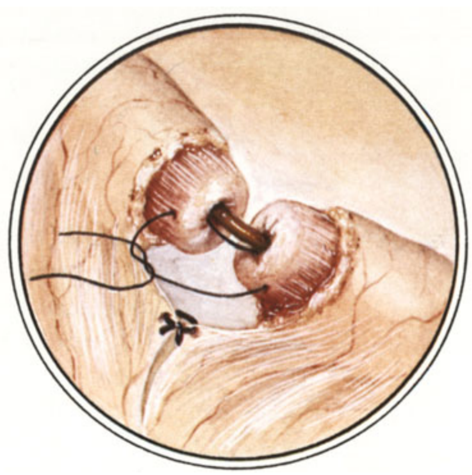


FIGURE 19-17. The isthmic-isthmic anastomosis has been prepared by placing a stay suture beneath the proximal and distal portions of fallopian tube. A 6 o'clock suture starts the muscularis to muscularis reanastomosis.

FIGURE 19-18. The completed muscular anastomosis has been completed with sutures placed in the 12, 3, 6, and 9 o'clock positions.

The muscularis layers of the proximal and distal ends are then approximated. The smallest caliber suture that the surgeon can handle with confidence should be used. The author prefers 9–0 nylon, though suture as large as 6–0 has been used satisfactorily.

The 6 o'clock suture is placed first (Fig. 19-17). Though there is some controversy on this point, it is quite acceptable to introduce the suture into the lumen of the tube if small caliber suture (8–0 or 9–0) is used. Sutures at 3 o'clock and 9 o'clock are placed and tied. The 12 o'clock suture is placed, at which time the stent is retrieved. The last suture placed is then tied (Fig. 19–18). Indigo carmine dye is introduced through the previously placed intrauterine catheter. Although it is desirable that the anastomosis be water tight, it is not essential, providing there is good spill of dye through the fimbria and no gross dye spill at the anastomosis. If there is profuse spill at the anastomosis and no dye from the fimbria, it is advisable to take down the anastomosis and reapproximate it rather than search for a specific leaking point. This will ultimately prove to be less frustrating and less likely to occlude the lumen.

Isthmic-Cornual Reanastomosis

Usually as a result of a unipolar coagulation or an extensive bipolar coagulation, there may be no immediately obvious proximal fallopian tube. This may be a situation where a tubal reimplantation is necessary. However, one may frequently identify intramural fallopian tube which can be anastomosed to the distal tube. This is considered more advantageous than a reimplantation because of its higher pregnancy potential. Before attempting to locate the isthmic tube, it is necessary to freely mobilize the distal tube and to remove remnants of mesosalpinx from the lateral walls of the uterus. This allows the surgeon to place a large looping suture through the lateral wall of the uterus to occlude some of the ascending branches of the uterine blood supply. This should be done on both sides before starting the search for the tubal lumen.

One should recall that the tubes come off quite high on the uterine fundus and frequently can be palpated even if not seen. If palpable, the suspected area can be stretched with a toothed forceps and incised with a No. 15 blade. After incising, dye is injected through the previously placed intrauterine catheter. A lumen not immediately evident may be seen in this manner. If a lumen is not observed, the bleeding points are carefully coagulated and a somewhat deeper slice is made. In carefully selected cases, one usually will be able to find an intramural tubal lumen.

Once identified, the opening is cannulated with a 3–0 suture (Fig. 19-19). The distal fallopian tube is prepared as in other anastomoses. Suturing the flat surface is more difficult than when the tube protrudes. Using the smallest ½ round needle available facilitates the anastomosis. It is again important that a stay suture of 4–0 or 5–0 be placed to fix the mesosalpinx of the distal tube to the lateral side of the uterus in order to take tension off the suture line (Fig. 19-20). Caution must be exercised that this suture not distort and occlude the distal tube.

Once the muscularis of the distal tube is anastomosed to the intramural tube, there may be considerable discrepancy between the circumference of serosa on the tube and the circumference of serosa on the uterus. If the difference is great, one should not force them together. This will distort the tube and create ischemia. It is better to anastomose the serosa of the tube to a convenient place on the uterine defect. The remainder of the uterine

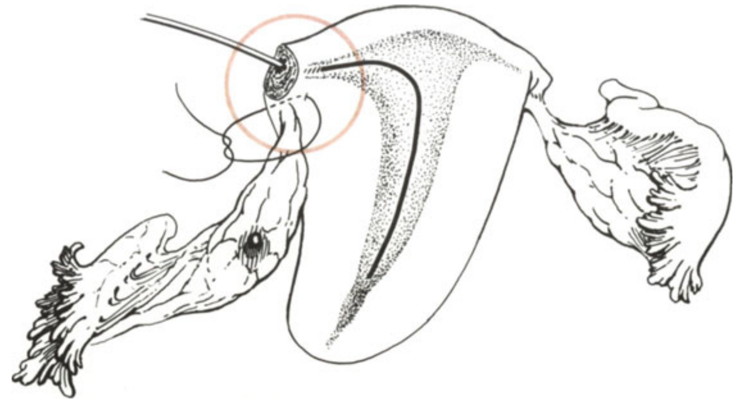


FIGURE 19-19. The cornual reanastomosis has been prepared by ligating ascending branches of the uterine vasculature. A stent has been placed through the cornual opening into the uterus.

defect can be closed on itself, or simply left alone. Patency should be tested by injection of dye through the endometrial catheter.

Cornual Reimplantation

This type of sterilization reversal is most commonly required following unipolar coagulation or bipolar coagulation performed at the cornu. One may elect to do this procedure primarily or by default, following the inability to locate the intramyometrial lumen of the fallopian tube when attempting an isthmic-cornual reanastomosis. Most often, the latter will be the case.

The distal portion of the fallopian tube is prepared differently from other sterilization reversal procedures. The distal tube is completely mobilized from the surrounding fibrous tissue and mesosalpinx. The end of the tube is held with a toothed forceps and stretched. A circumferential incision is made through the serosa approximately 1 cm from the distal end of the tube. The serosa is stripped from the underlying muscularis using forceps and snips with an iris scissors. Small bleeding points on the muscularis are coagulated with the bipolar coagulating forceps. The distal end of the tube is then amputated, exposing the lumen. A 5–0 Prolene suture is placed through the full thickness of the tube at the 3 o'clock and 9 o'clock positions and brought out of the tubal lumen. Using these sutures as guy wires, the full thickness of the tube is incised at the 12 o'clock and 6 o'clock positions, creating a fish-mouth opening (Fig. 19-21). The sutures are kept in place for further use.

The lateral surfaces of the uterus usually have been previously prepared by the unsuccessful attempt to locate an intramyometrial tubal lumen. If not, the area is prepared by stripping vestiges of mesosalpinx and bilaterally ligating ascending branches of the uterine vessels.

A reamer or cork borer is selected based on the diameter of the muscularis of the distal tube. It is rotated through the cornual myometrium. Entrance into the uterine cavity is confirmed by dye injected through the endometrial catheter, which issues through the lumen of the reamer.

Bleeding points are coagulated, though controlling all bleeding is difficult and unnecessary. If the proper size reamer has been selected, the tubal muscularis will tamponade small bleeders created by the reamer.

A 3–0 nylon or Prolene stent is placed through the lumen of the fish-mouthed fallopian tube and fed into the endometrial cavity. A large ½ round needle is affixed to one end of the suture, which penetrates one of the fish-mouthed halves. The needle carefully guides the suture end into the endometrial cavity and then penetrates the myometrium. The other end of the same

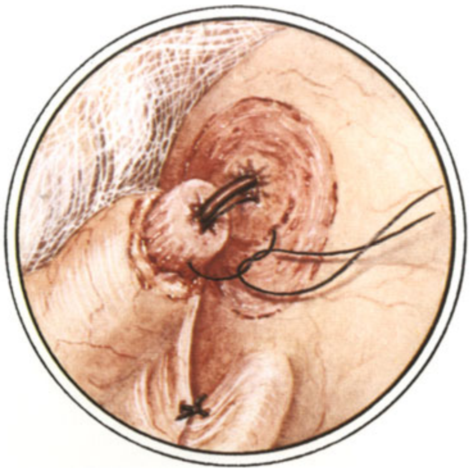


FIGURE 19-20. The isthmic-cornual reanastomosis has been initiated by stenting the lumen between the isthmus and the cornu. A stay suture has been placed beneath the distal fallopian tube and the cornual opening.

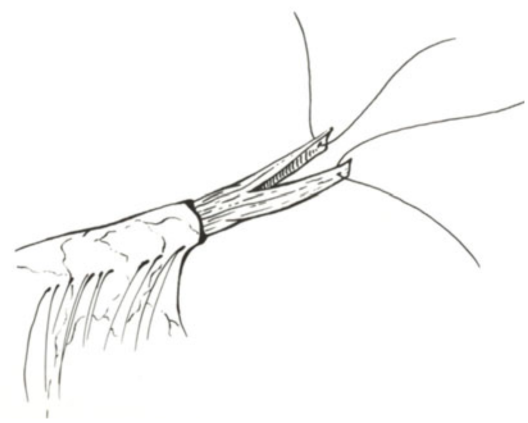


FIGURE 19-21. One cm of distal fallopian tube serosa has been excised, exposing the mucularis. The muscularis has been incised, creating a "fish mouth" opening. A suture has been placed through each of these halves to subsequently guide them into the endometrial cavity.

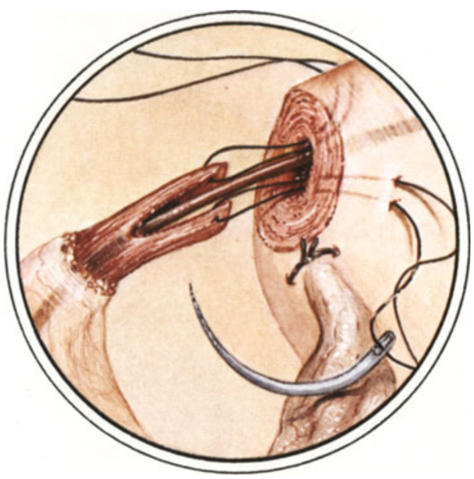


FIGURE 19-22. A stent is placed from the distal end of the fallopian tube into the uterus. The sutures previously placed through the "fish mouth" halves are brought first into the endometrial cavity, then through the walls of the myometrium.

suture is brought into the endometrium and brought through the myometrium a few millimeters lateral to the first suture (Fig. 19-22). These two suture ends will be used to draw the tube into the endometrial cavity. The suture ends on the opposing fish-mouthed half are similarly brought into the endometrial cavity and penetrated through the myometrium. Each of these sets of guy wires is then tightened, guiding the tube into the opening, and spreading open the two halves of the fish-mouth in the endometrial cavity. Each of the sets of sutures is then tied together.

A series of sutures is then used to fix the tubal muscularis to the myometrium. A 4–0 nylon suture fixes the mesosalpinx to the lateral uterine wall to relieve tension on the suture line. If carelessly placed, this suture will distort and possibly occlude the fallopian tube.

The serosa is approximated with a series of interrupted sutures. The stent is left in place 10 to 14 days and removed as an outpatient procedure by grasping with a uterine dressing forceps. In rare cases hysteroscopy may be required to identify and remove the stent.

Salpingostomy

Of all the reparative procedures on the fallopian tube, the salpingostomy requires the most individualization. Rarely is the exact procedure repeated, though certain principles are constant.

After the abdomen is opened, any adhesions of bowel or omentum to the adnexa are lysed and the bowel packed away. It is first necessary to totally free the adnexa from adhesions to surrounding structures. Usually, one encounters the ovary fixed to the posterior leaf of the broad ligament. Constant traction on the ovary with counter traction on the broad ligament usually defines the line of adhesion. Although much of the dissection is performed with a needlepoint unipolar cautery, this particular dissection is most safely accomplished with sharp dissection. Wescott or iris scissors is the author's choice (Fig. 19-23). Once a plane is defined, it usually is easy to continue the dissection, freeing the ovary from the underlying tissue. It is wise to identify the ureter and the major vessels. Bleeding points on the lateral pelvic wall created by freeing the ovary then can be ligated with 5–0 Prolene or PDS suture. It is advisable to close any rent in the broad ligament at this time. Adhesions of the mesosalpinx to the meso-ovarium are identified by passing a glass or Teflon rod behind the adhesion and dissecting it free, using unipolar current. One should be careful to avoid cutting the fimbria ovarica during this process.

If the hydrosalpinx is large, one will find that the end has coiled on itself, leaving its end deeply buried and its antimesenteric border exposed. One should not attempt to open the tube in this condition as it will lead into the blind cul-de-sac of the coiled tube. Efforts should be made to dissect the mesenteric

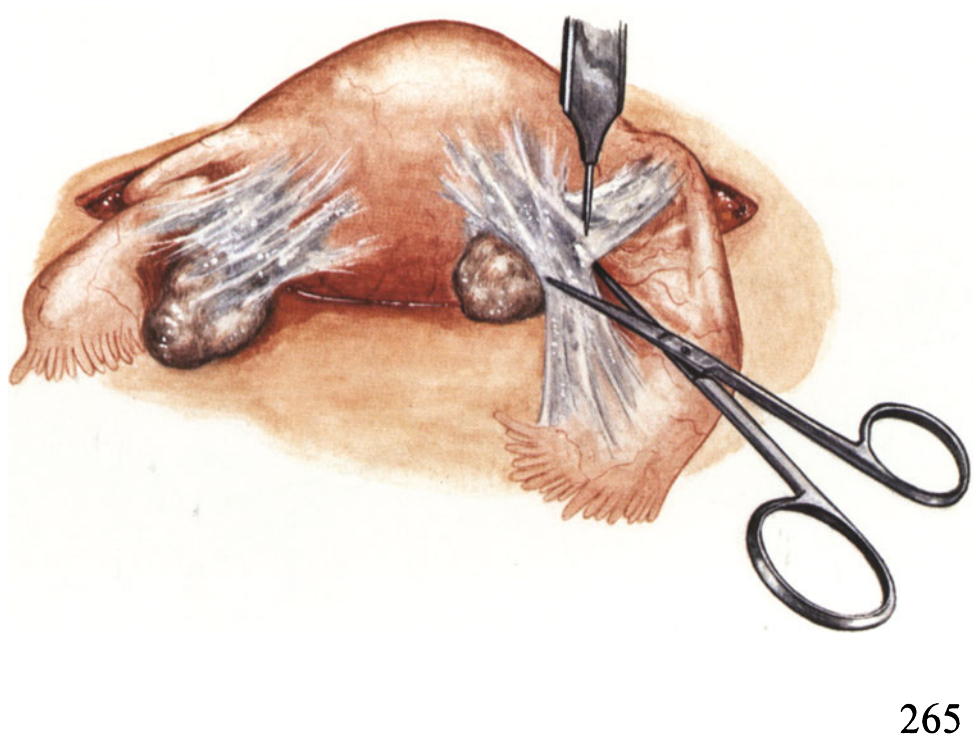


FIGURE 19-23. Adhesions are incised with Wescott or iris scissors.

side of the coiled hydrosalpinx, ultimately straightening it and exposing the punctum into which the fimbria originally invaginated. If this point is identifiable, it should be sharply dissected and opened. Lysing constricting transverse bands may allow evagination of the remaining fimbria. If such is not the case, a glass rod is introduced into the opening. The glass rod is used to guide the dissection away from any remaining plicae, allowing the tube to be opened in the most avascular areas. If no clear dissection plane becomes evident, a stellate incision is made. The point of each new triangular flap is sutured back onto the tubal serosa with 8–0 nylon suture (Fig. 19-24). Troublesome bleeding usually is subserosal or deep to a transected plical fold. Looking for bleeders in these specific locations allows bleeding to be quickly controlled with a bipolar coagulator.

The CO_2 laser can be used to open the hydrosalpinx and to evaginate the edges of the salpingoneostomy. All of the precautions for the use of carbon dioxide laser should be observed. This method should be used only by individuals who understand the hazards of laser use and have been trained in its use. While there has been some suggestion that the use of the laser decreases adhesion formation and fibrosis, this has not been demonstrated experimentally or clinically. In fact, studies comparing incisions made with laser, cold knife and hot knife have demonstrated an increase in fibrosis with the use of the carbon dioxide laser.[5] Nonetheless, if such facilities are available in the operating room, one may find the laser a convenience in opening the hydrosalpinx in which recovery of fimbria has been abandoned.

The hydropsalpinx is dissected free in the manner previously described. Moistened packs are used to surround the operating field. The hydrosalpinx is distended with indigo carmine dye which is delivered through a previously placed intrauterine Foley catheter. The laser beam can be delivered through a hand-held piece, or through an attachment allowing the use of a joy stick affixed to an operating microscope. In either circumstance, the procedure is similar. A cruciate incision is made with the CO_2 laser set on a superpulsed

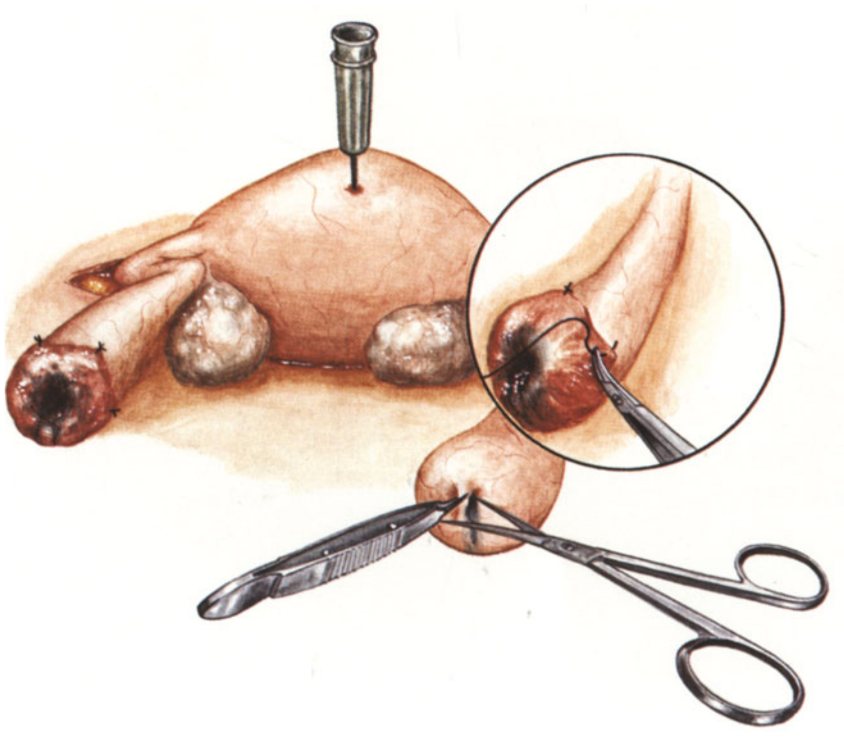


FIGURE 19-24. The hydrosalpinx has been freed from adhesions to the ovary and side wall. The hydrosalpinx has been opened and serosa everted and sutured with 8–0 nylon.

FIGURE 19-25. The tube is distended with indigo carmine dye. The CO_2 laser beam is being delivered with a hand held piece. The laser is set on superpulse. Approximately 10 to 15 watts of energy is required. A cruciate incision is made.

FIGURE 19-26. A cruciate incision has been made in the distal end of the hydrosalpinx, creating four triangular flaps. The laser beam has been retracted, defocusing the beam. The wattage has been significantly reduced. The defocused beam is used to evaporate the serosa of the flap, beginning at the tip, and progressing to the base. This everts the triangular flap.

or continuous beam. The wattage must be individually adjusted; approximately 10 to 15 watts are generally required for a clean incision. Once the initial opening is made, as evidenced by the extrusion of the indigo carmine dye, the laser beam is used to create a four-flap opening (Fig. 19-25). Significant bleeding is controlled with a microbipolar coagulator as previously described. The use of a quartz rod as a backstop for the laser beam is important to prevent damage of the remaining tubal mucosa.

After the cruciate incision has been made, the CO_2 laser is set to deliver a continuous rather than a pulsed beam. The beam is defocused and the wattage significantly reduced. With this configuration, the serosa overlying each triangle is progressively evaporated from its tip to its base (Fig. 19-26). The resulting contracture causes eversion of the newly created flap. Using this technique, it is possible to avoid the use of sutures entirely.

Management of the Unruptured Ectopic Pregnancy

The unruptured ectopic pregnancy usually is found in the midisthmic portion of the fallopian tube. It is next most commonly found in the ampullary portion. It occasionally occurs near the cornu of the uterus. If the unruptured ectopic pregnancy occurs near the cornu, it is not advisable to attempt to salvage the fallopian tube. A salpingectomy or a salpingo-oophorectomy should be performed. If the pregnancy occurs near the ampullary portion of fallopian tube, one should avoid the inclination to express the pregnancy from the end of the fallopian tube. This results in increased bleeding, an increased rate of tubal obstruction, and an increased rate of recurrent ectopic pregnancy. A pregnancy at the ampullary portion should be treated in the same manner as a pregnancy in the isthmic portion of fallopian tube. The fallopian tube should be brought into the anterior abdominal incision and held at the mesosalpinx. Using a unipolar cautery needle, an incision should be made on the antimesentery border of fallopian tube. It is not necessary to make the incision

FIGURE 19-27. The dilated fallopian tube has been incised. The ectopic pregnancy is teased from the incised opening of the fallopian tube by digital pressure at the mesosalpingeal border and gentle forceps manipulation.

as long as the pregnancy bulge. The incision is carefully extended through the tubal layers until trophoblast material is observed. A small amount of pressure applied by the fingers holding the mesosalpinx will allow the trophoblast to exude through the opening (Fig. 19-27). It is not necessary to completely remove the trophoblast from its bed in the fallopian tube, as this will create excessive bleeding that is difficult to control. After the trophoblastic tissue has protruded through the incision, a small amount of tissue may be found fixed at the implantation site. This is allowed to remain, much in the same manner as one manages the implantation site in an intra-abdominal pregnancy. The bleeding points usually are found in the subserosa. These are coagulated using bipolar coagulating forceps. After adequate hemostasis has been obtained, no effort is made to repair the defect. An HSG performed 3 months later will usually show closure of the defect and patency of the fallopian tube.

As more linear salpingostomies are performed for unruptured ectopic pregnancies, a specific defect is being seen more frequently. This appears as an "aneurysm" at the site of the linear salpingostomy. Because of the increased chance of recurrent ectopic pregnancy at this site, the aneurysm should be excised. This is accomplished in the manner of a microsurgical tubal reanastomosis. The complete weakened area is excised, and the remaining proximal and distal tube reanastomosed.

Adjuvants

Various methods have been suggested to decrease the formation of postoperative adhesions. It should be noted that none of these is a substitute for exercising surgical techniques that prevent tissue destruction with resulting ischemia. Ischemia is the primary stimulus to the formation of adhesions. One should avoid attempts to "reperitonealize" denuded areas with nonvascularized free peritoneal or free omental grafts. High doses of glucocorticoids combined with promethazine have been used commonly since first described by Horne and colleagues in the early 1970s.[4] No subsequent study has found an increase in pregnancy rate or decrease in adhesion rate in humans with this regimen. Other efforts to decrease adhesions include the use of heparinized Ringer's lactate solution for irrigation, the use of postoperative antiprostaglandins, and postoperative hydrotubation with a variety of substances. None of these regimens has been shown to increase the pregnancy rate or decrease the rate of adhesions in humans. The only adjunctive technique that has been demonstrated to increase the pregnancy rate following salpingectomy is the instillation of 200 cc of dextran-70, into the peritoneal cavity immediately prior to closing the peritoneal cavity. This material creates an increase in the intraperitoneal osmotic pressure. The result is a significant fluid shift from the intravascular space into the peritoneal cavity. The resulting "flotation" of pelvic structures is presumed to be the mechanism of decreasing adhesions. Though anaphylaxis to dextran-70 has been reported in rodents, there has been only a single case report in humans. The patient's fluid dynamics should be carefully monitored if dextran-70 is used.

References

1. Federation CECOS, Schwartz D, Mayaux MJ: Female fecundity as a function of age: Results of artificial insemination in 2193 nulliparous women with azospermic husbands. *N Engl J Med* 1982; 306:404–406.
2. Grunert GM, Drake TS, Takaki NK: Microsurgical reanastomosis of the fallopian tubes for reversal of sterilization. *Obstet Gynecol* 1981; 58:148–151.
3. Hook EB: Rates of chromosomal abnormalities at different maternal ages. *Obstet Gynecol* 1981; 58: 282–285.
4. Horne HW, Clyman M, Debrovner C, et al: The prevention of postoperative pelvic adhesions following conservative operative treatment for human infertility. *Int J Fertil* 1973; 18:109–115.
5. Sowa DE, Masterson BJ, Nealon N, et al: Effects of thermal knives on wound healing. *Obstet Gynecol* 1985; 66:436–439.
6. Swolin K: Fifty fertility operations. I. Literature and methods. *Acta Obstet Gynecol Scand* 1967; 46:234–250.
7. Weström L: Effect of acute pelvic inflammatory disease on fertility. *Am J Obstet Gynecol* 1975; 121:707–713.

20 Ectopic Pregnancy

Between 1970 and 1980 the number of hospitalizations in the United States for ectopic pregnancy increased from 17,800 to 52,200[10] (Fig. 20-1). This represents an almost threefold increase in the rate of ectopic pregnancy, from 4.8 per 1,000 live births in 1970 to 14.5 per 1,000 in 1980.[7] Deaths from ectopic pregnancy expressed as a percentage of all maternal deaths increased from 7.8% in 1970 to 11.5% in 1978.[16] The death to case rate, however, decreased almost fourfold from 3.5 per 1,000 ectopic pregnancies in 1970 to 0.9 per 1,000 in 1980.[7] In Breen's series of 654 ectopic pregnancies, 89% of patients had previously been pregnant, demonstrating a high fertility index in this group of patients[2]; 10% to 20% of ectopic pregnancies resulted from tubal surgery for infertility.[4] Of the 654 ectopic pregnancies, 97.7% were located in the tube; the others were located in the abdomen or ovary. Of the 639 tubal gestations, 41% occurred in the distal third of the tube, 38% in the middle third, and the remaining 21% in the proximal third interstitial portion or in the fimbria[2] (Fig. 20-2). The common denominator in this group of patients is delay in transport of the ovum fertilized in the ampulla of the tube to the normal implantation site in the uterus.

One of the more common predisposing factors to ectopic pregnancy is pelvic inflammatory disease (PID) with salpingitis and resultant fibrosis, peritubal adhesions, and diverticula. Brenner reviewed 300 consecutive ectopic pregnancies in 1980 and noted a 36.3% incidence of PID by history and physical findings.[3] Weinstein noted in his review of 154 ectopic pregnancies in 1983 a 19.5% incidence of PID by history and a 44% incidence by histologic slide review.[21] An increase in pelvic inflammatory disease is seen in the younger population and is associated with earlier sexual relations and the use of intrauterine devices (IUD).[13]

The role of the IUD in ectopic pregnancy is controversial. It may be that rather than causal, it is just not preventative. Lehfeldt estimated that it reduces the risk of intrauterine pregnancy by 99.5%, tubal pregnancy by 95%, and ovarian pregnancy not at all.[11] Ory concluded after analyzing 615 women with prior ectopics and 3,453 controls that an IUD-user had the same risk for ectopic pregnancy as a nonuser.[14]

At laparotomy gross evidence of PID may be found in patients with ectopic pregnancies; however, 50% of patients have grossly normal adnexae. Remember that the normal external appearance of a fallopian tube may not be a

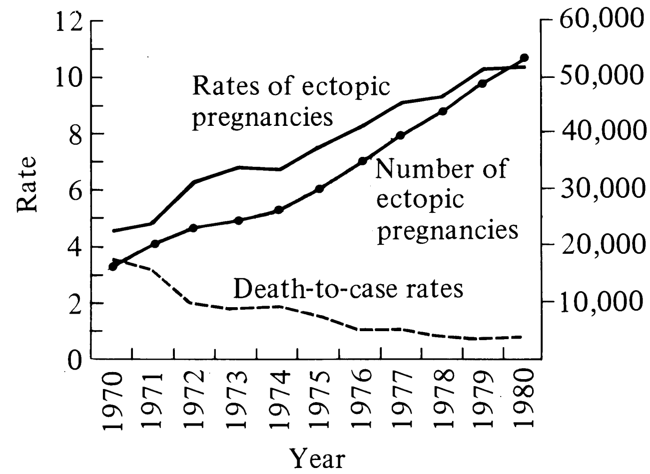


FIGURE 20-1. Number of ectopic pregnancies, rates of ectopic pregnancies, and death to case rates, United States, 1970–1980. (Reprinted with permission from The American College of Obstetricians and Gynecologists: Dorfman SF: *Obstet Gynecol* 1983; 62:335. Adapted from: Centers for Disease Control: MMWR 1984; 33:201.)

true reflection of the condition of the tubal mucosa. Additional predisposing factors include the presence of ectopic endometrium in the tube, transperitoneal migration of the ovum (implicated in 20% to 50% of cases by the finding of a corpus luteum in the contralateral ovary), and inflammatory changes of a prior ectopic pregnancy. The data for the incidence of recurrent tubal gestational implantations with the different kinds of tubal reconstructive surgery vary in the literature. An average figure would be 20% for tubal reimplantation, midsegment tubal anastomosis, and salpingostomy. More than 50% of the patients who have an ectopic pregnancy become infertile.[4]

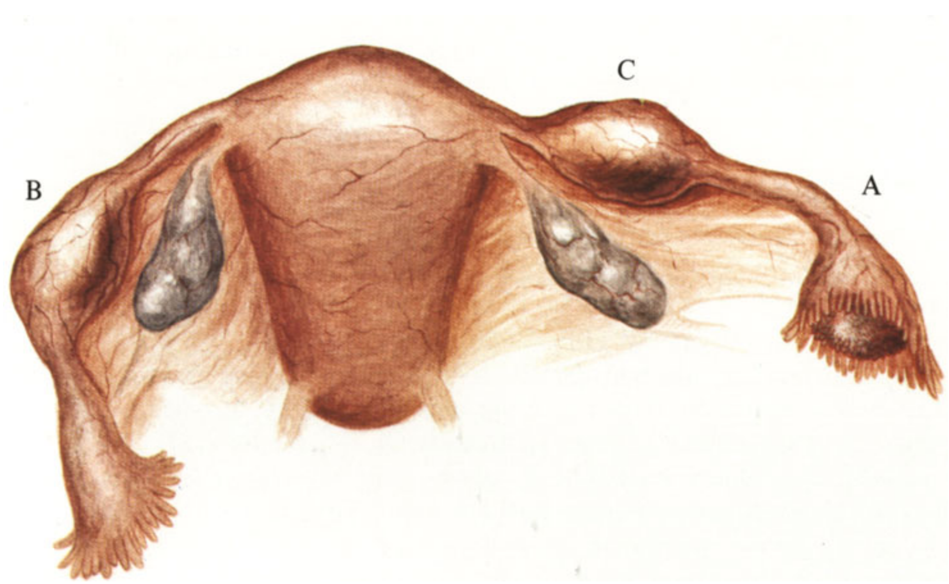


FIGURE 20-2. Common locations of ectopic pregnancy. **A:** Distal third of the tube. **B:** Middle third of the tube. **C:** Proximal third of the interstitial portion of the tube. The distal third is the most common site.

Preoperative Evaluation

The most common symptom in ectopic pregnancy is abdominal pain, usually in the lower abdomen, which occurs approximately 3 to 5 weeks after missed menses. When shoulder pain occurs, it is safe to assume the ectopic pregnancy has ruptured. If the lesion is in the fimbria or distal ampulla, distention in the peritoneal surfaces occurs later and symptoms are not noticed as soon. Vaginal bleeding occurs in 80% of patients, usually in scanty amounts.[2]

Physical findings are quite variable. The most common are a fullness in the cul-de-sac and tenderness on motion of the cervix in approximately 87% of patients, localized tenderness in 60%, and rebound tenderness in 52%. Approximately 50% of patients have a mass on examination and, depending on the progress of the disease, as many as 50% are admitted in shock, usually on a hemorrhagic basis.[2]

A number of women have vague abdominal symptoms consisting primarily of pain without specific findings; one should be highly suspicious of ectopic pregnancy in these patients. Diagnostic laparoscopy is indicated and often reveals blood in the peritoneal cavity, tubal distention, and bleeding from the tube.

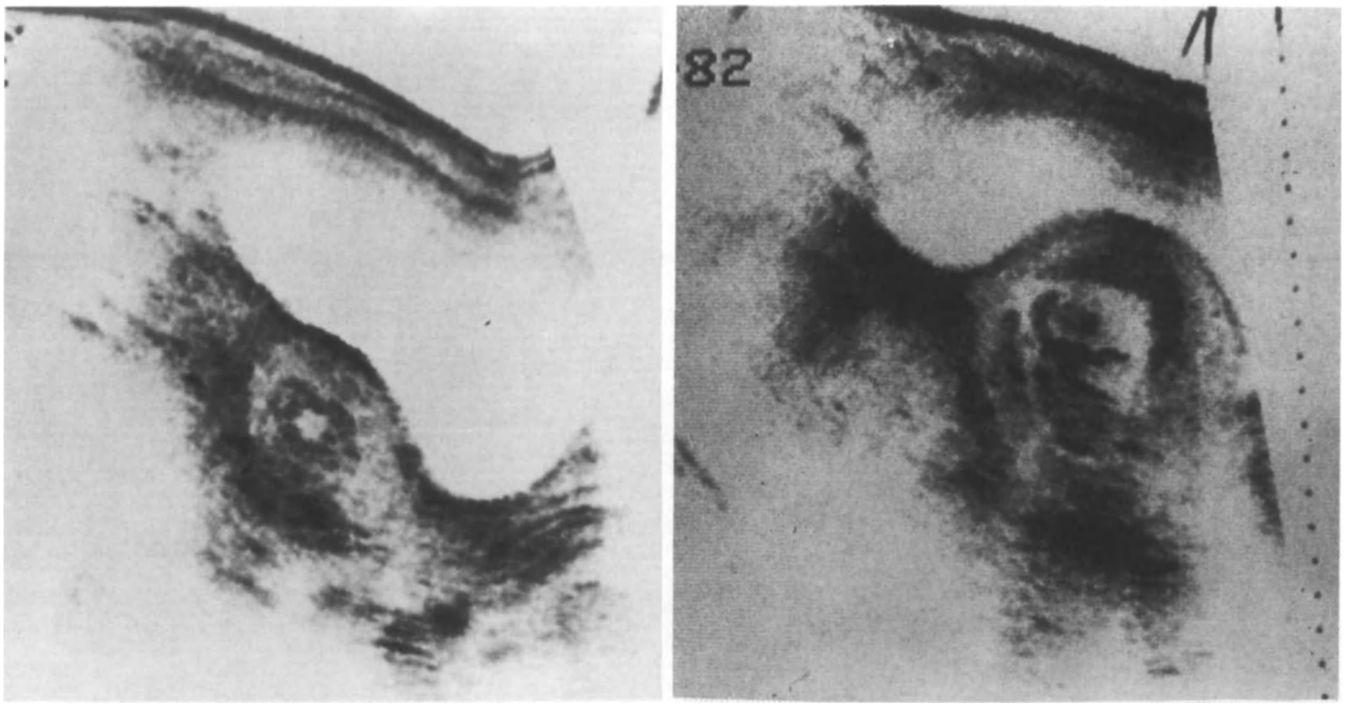
Laboratory test findings are variable. The most reliable procedure is culdocentesis, which documents bleeding of the pregnancy into the abdomen. Brenner reported nonclotting blood in 95% of patients who had culdocentesis.[3] The hematocrit was determined on all culdocentesis fluid and was greater than 15% in 97.5% of specimens.

The frequency of positive human chorionic gonadotropin (HCG) measurements varies from series to series and is a function of the age of the gestation at the time of presentation. In Brenner's report on 300 patients there was an 83% incidence of positive urinary HCG; however, 29% of these ectopics were ruptured at laparotomy.[3] The advent of readily available β-HCG determinations has greatly improved the ability to diagnose pregnancy. HCG is secreted by trophoblastic tissue and can be detected in maternal blood serum as early as 10 days after ovulation, if fertilization has occurred. Bryson noted that the combination of a positive β-HCG and an ultrasound demonstrating no intrauterine gestational sac (Fig. 20-3) in 81 consecutive at risk patients was diagnostic of ectopic pregnancy with no false positives and no false negatives.[5] Based on these observations, a protocol for the evaluation of possible ectopic pregnancies can be derived (Fig. 20-4).

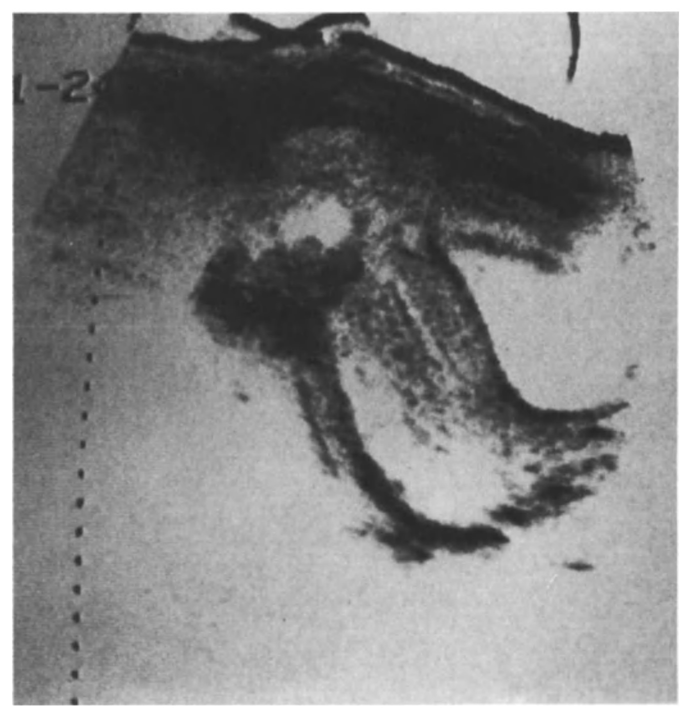
Operative Strategy

The patient who desires no further children presents a relatively simple surgical problem after diagnosis is made. Salpingectomy is the standard treatment for ectopic pregnancy (Fig. 20-5). If the patient chooses, tubal ligation may be performed in the opposite tube as well.

The difficulty in the management of ectopic pregnancy occurs in those patients who desire continued fertility, and a great deal of controversy surrounds the most effective means of treating these patients. The difficulty of evaluating the noninvolved tube by gross inspection has been noted. It is also difficult to estimate the damage to the tubal epithelium in the noninvolved tube caused by the inflammatory changes resulting from the current ectopic pregnancy. If the diagnosis is unruptured ectopic pregnancy, conservative surgery is recommended if the patient has a fertile husband, is 35 years of age or less, has no other contraindications to future pregnancy, is in satisfactory condition at the time of laparotomy, and is apprised of the increased risk in



6-week fetus (*left*), 9-week fetus (*right*).



Ectopic pregnancy.

FIGURE 20-3. Ultrasound scans of a 6-week fetus, a 9-week fetus, and an ectopic pregnancy. Note the presence of a gestational sac in the uterine pregnancies.

surgery to maintain her fertility. Bronson discusses in detail the strategy to maximize fertility.[4]

The tube must be excised when the rupture of the tubal implantation has led to hemorrhage and extensive tubal damage. When hemorrhage extends into the mesosalpinx and meso-ovarian, oophorectomy also is indicated.

There is accumulating experience that shows that conservation of the involved tube increases the likelihood of future fertility without greatly increasing subsequent risk of recurrent ectopic pregnancy. As most implantations occur within the ampulla or are attached to the fimbria, the pregnancy may be expressed and separated from the tube without difficulty.[4] Timonen and Niemi-

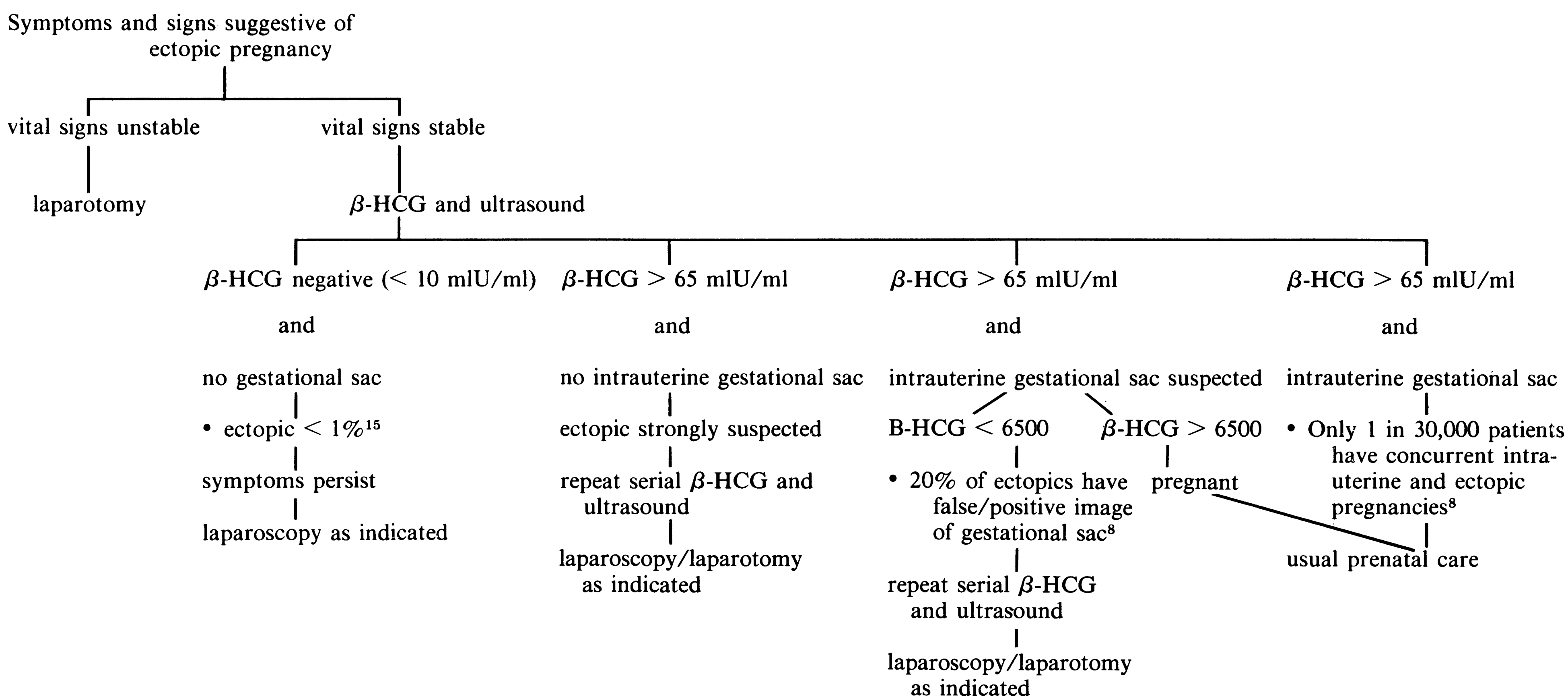


FIGURE 20-4. Protocol for evaluating the patient suspected of having an ectopic pregnancy. In evaluating the pelvic ultrasound it should be remembered that a gestational sac cannot reliably be detected before 25 days after conception. In a viable pregnancy this corresponds to β-HCG values of >1,000 mIU/ml.[6] If no sac is noted in the uterus and an ectopic is suspected, the condition of the patient should determine the advisability of waiting to repeat the ultrasound or proceeding to laparoscopy/laparotomy. The doubling time for B-HCG in serum is 2.3 days in early pregnancy.[8] Remember, the purpose of ultrasound is to demonstrate an intrauterine sac. Only 4% of ectopics have an ultrasonically identifiable fetal mass and sac in the tube.[8] In confusing cases, remember cervical pregnancy, abdominal pregnancy and trophoblatic disease.

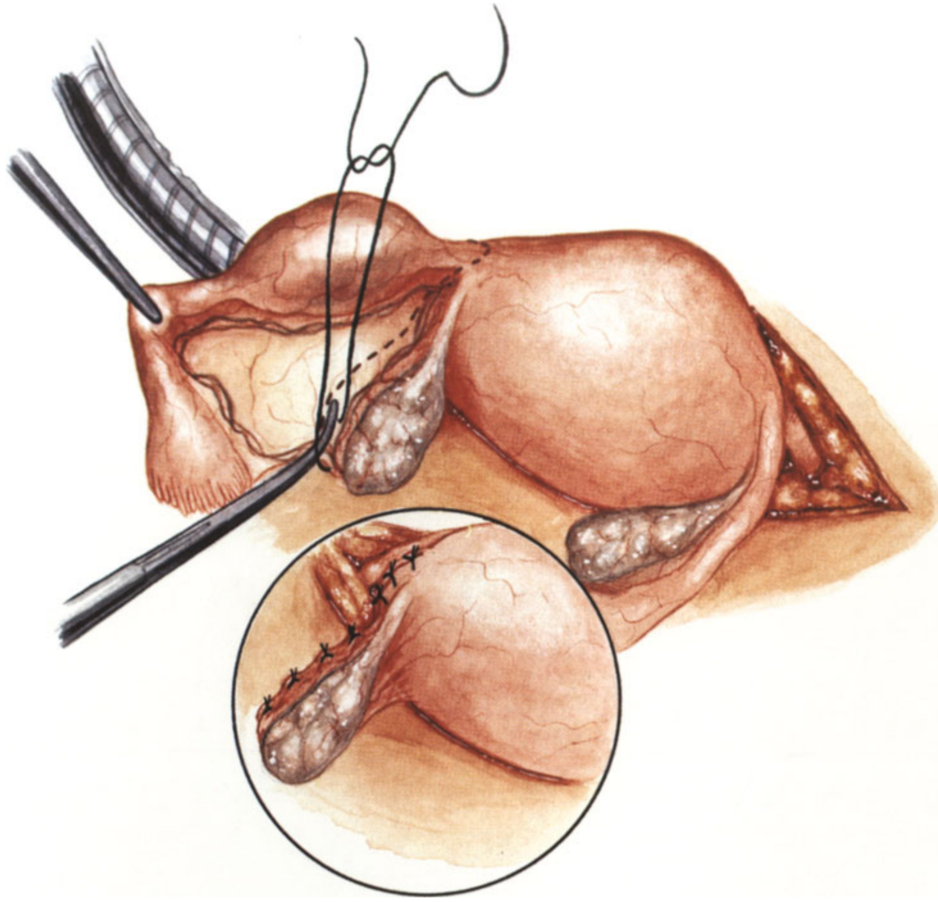


FIGURE 20-5. Salpingectomy. After the abdomen has been opened and the pregnancy site identified, place a fiberoptic light source behind the broad ligaments, transilluminating the blood vessels as they course through the meso-ovarium. Place Gemini artery forceps and divide the mesentery between clamps. Secure each bite on the ovarian side with suture ligatures of 3–0 or 4–0 braided nylon. Incise the junction of the tube and uterine cornua; close these incisions as well. Carefully inspect the excision site for any additional bleeding and always identify the ureter prior to placing the first clamp along the ovary. If bleeding occurs in the ovary, the ovary is excised at this time. Irrigate any blood from the peritoneal cavity, and close the abdomen and wound in layers. Approximate the anterior rectus fascia with continuous sutures of 2–0 polydioxanone. The skin is approximated with 4–0 absorbable subcuticular sutures or 3–0 nylon subcuticular closure with 5–0 nylon interrupted sutures to even any ridges produced.

nen have evidence, however, that the incidence of recurrent ectopic pregnancies may be higher with expression of the tubal gestation as compared with salpingostomy. (See Chapter 19.) This may be due to retained trophoblastic tissue.[19] Tompkins suggests surgical removal of the ectopic pregnancy under direct vision by incising the antimesenteric aspect of the tube, securing hemostasis, and leaving the tubal incision open.[20] Using a similar approach, DeCherney reported a series of 15 patients in whom the involved oviduct was the sole oviduct. There was a 53% incidence of viable pregnancy and a 20% incidence of repeat ectopic pregnancy in these conservatively managed patients.[9] The cumulated results of conservative management of ectopic pregnancy with only one oviduct demonstrates a 61% incidence of subsequent intrauterine pregnancies and an 11% incidence of repeat ectopic pregnancy.[9]

When the pregnancy is farther from the end of the tube, a linear incision

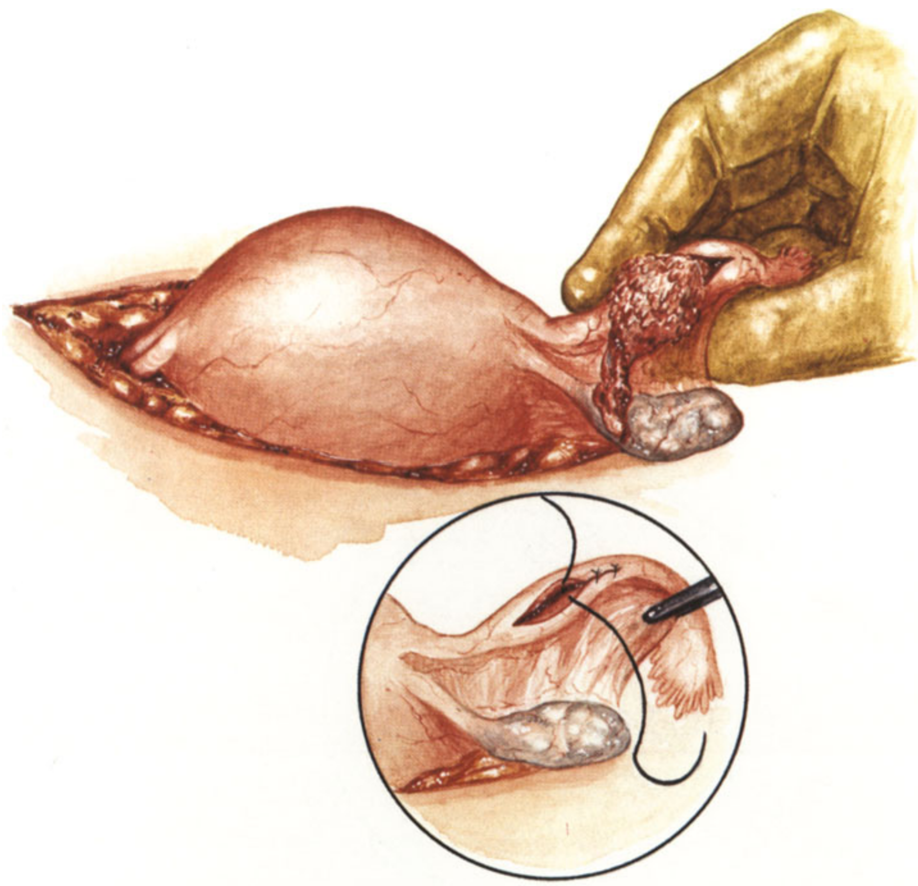


FIGURE 20-6. Linear Salpingostomy. Surgery of ectopic pregnancy farther from the end of the tube. Make an incision over the tubal pregnancy, applying pressure with the finger and thumb beneath the ectopic gestation. Using a No. 15 blade, incise each layer in entering the tubal lumen. Express the products of conception and irrigate the tubal lumen. Secure hemostasis with a very fine tipped cautery or 4–0 or 5–0 absorbable suture. Gently irrigate any adherent blood clots remaining from the tubal lumen. *Inset:* Close the tube by suturing small portions of the muscularis, avoiding the mucosa. If the tube cannot be approximated owing to edema or hemorrhage, secure hemostasis with ties and delicate cautery and leave the tube open.

over the ectopic pregnancy and removal of the gestational sac and trophoblastic tissue is recommended (Fig. 20-6). If the pregnancy is of the less common isthmic variety, excision of that portion will probably be required. Cornual reimplantation may be done at a later date by a surgeon who has a particular interest in infertility surgery.[4] In Timonen and Nieminen's series of 92 patients with linear salpingostomy, 76 had bilateral tubal patency. Recurrent ectopic pregnancy following linear salpingostomy occurred in 12% of patients and 30% had normal term pregnancies.[19] Although oophorectomy has been advocated when salpingectomy is necessary to decrease the incidence of tubal pregnancies due to transmigration, Bender's data indicate that the incidence of recurrent ectopic pregnancy is approximately the same with salpingo-oophorectomy as with salpingectomy.[1] The expansion of in vitro fertilization programs should make excision of a noninvolved ovary a moot point.

Postoperative Management

Apprise the patient of the increased incidence of repeat ectopic pregnancies. If sterilization results from the procedure, the patient needs to fully understand the thinking behind the decision. Finally, if additional surgical procedures are necessary to improve the patient's fertility, refer the patient to a surgeon experienced in microsurgery.

Routine appendectomy may be performed with surgery for tubal pregnancy if the patient is in good condition and the appendix is easily exposed. Onuigbo noted a 25% febrile morbidity rate in a series of 264 laparotomies for ectopic pregnancy irrespective of incidental appendectomy.[12] Routine appendectomy is not done if any reconstructive procedure has been performed in an attempt to maintain fertility.

Schneider et al reviewed maternal mortality due to ectopic pregnancy and found an impressive delay between the onset of symptoms and definitive therapy as well as an average delay of three days between consultation and hospital admission.[18] All facets of delay were generally higher in patients treated in university hospitals. They postulate that laparoscopic investigation, aggressive surgical management, and adequate blood replacement would save up to 75% of the patients who die of ectopic pregnancy.

Cervical and Abdominal Pregnancy

Though extremely rare, recent case reports concerning management of these potentially fatal complications of conception require mention of hemostatic techniques. Cervical pregnancy has been noted in various reports to occur from one in 1,000 to one in 18,000 pregnancies. Evacuation of the cervix results in profound hemorrhage since the body of the cervix lacks the contractile, hemostatic capacity of the corpus. Hemostasis has been accomplished with packing, ligation of the descending cervical arteries, inflated intracervical urethral catheters, prophylactic/therapeutic hypogastric artery ligation, and ultimately hysterectomy. The size of the gestation and degree of bleeding should dictate the approach taken.

The management of abdominal pregnancy, specifically the placenta, has generated controversy recently. Sandberg and Pelligra have advocated progressive surgical removal of the attached placenta.[17] Maximum local hemostasis is accomplished followed by closure of the abdomen and application of the military antishock trousers (MAST) (Figs. 20-7 and 20-8). In the three patients presented, the effect of 20 to 30 mm extracorporal pressure dramatically controlled hemorrhage. Experimentally, circumferential pneumatic compression has been shown to prevent the flow of blood from incisions 5 mm long in the abdominal aorta and from the open ends of fully transected common

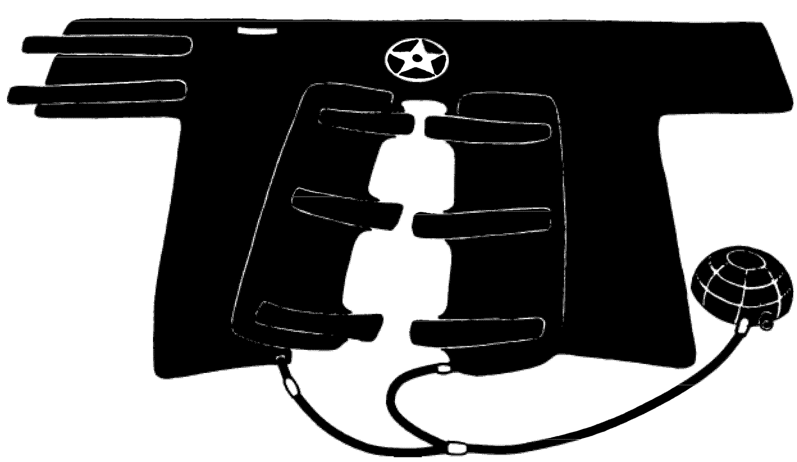


FIGURE 20-7. MAST suit.

FIGURE 20-8. MAST suit applied to patient.

TABLE 20-1. Current Recommendations for Use of the MAST Suit in Controlling Intra-Abdominal Hemorrhage

Close wound snugly
Insert indwelling urinary catheter
Apply garment
Inflate to 20 to 25 mm Hg, legs first, then abdomen
Maintain pressure for 12 to 36 hours
During this interval:
Correct hypovolemia (if replacement of large volumes is necessary, insert central venous pressure line or Swan-Ganz catheter)
Replenish coagulation factors
Maintain normal respiratory exchange and acid-base balance (if mechanical ventilation is necessary, insert endotracheal tube and arterial catheter)
DO NOT DEFLATE GARMENT, EVEN MOMENTARILY
After this interval:
Deflate garment slowly over 15 to 30 minutes, legs first (if systolic pressure falls more than 10 mm Hg, reinflate and correct hypovolemia before repeating)

From Sandberg EC, Pelligra R.[15]
MAST, military antishock trousers.

iliac arteries. Clinically, it has been shown to stop intra-abdominal hemorrhage associated with ruptured aortic aneurysm, ruptured liver, pelvic fracture, percutaneous renal biopsy, hypocoagulation, tubal pregnancy, placenta accreta, and obstetric lacerations.[17] Current recommendations for use of the suit are given in Table 20-1.

References

1. Bender S: Fertility after tubal pregnancy. *J Obstet Gynaecol Br Emp* 1956; 63:400–403.
2. Breen JL: A 21 year survey of 654 ectopic pregnancies. *Am J Obstet Gynecol* 1970; 106:1004–1019.
3. Brenner PF, Roy S, Mishell DR: Ectopic pregnancy: A study of 300 consecutive surgically treated cases. *JAMA* 1980; 243:673–676.
4. Bronson RA: Tubal pregnancy and infertility. *Fertil Steril* 1977; 28:221–228.
5. Bryson SCP: β-subunit of human chorionic gonadotropin, ultrasound, and ectopic pregnancy: A prospective study. *Am J Obstet Gynecol* 1983; 146:163–165.
6. Cartwright PS, DiPietro DL: Ectopic pregnancy: Changes in serum human chorionic gonadotropin concentration. *Obstet Gynecol* 1984; 63:76–80.
7. Centers for Disease Control: Ectopic pregnancies—United States, 1970–1980. *MMWR* 1984; 33:201–202.
8. DeCherney AH, Jones EE: Ectopic pregnancy. *Clin Obstet Gynecol* 1985; 28:365–374.

9. DeCherney AH, Maheaux R, Naftolin F: Salpingostomy for ectopic pregnancy in the sole oviduct: Reproductive outcome. *Fertil Steril* 1982; 37:619–622.
10. Dorfman SF: Deaths from ectopic pregnancy, United States, 1979 to 1980. *Obstet Gynecol* 1983; 62:334–338.
11. Lehfeldt H, Tietze C, Gorstein F: Ovarian pregnancy and the intrauterine device. *Am J Obstet Gynecol* 1970; 108:1005–1009.
12. Onuigbo WTB: Elective appendectomy at salpingectomy for ectopic pregnancy. *Obstet Gynecol* 1977; 49:435–437.
13. Ory HW: A review of the association between intrauterine devices and acute pelvic inflammatory disease. *J Reprod Med* 1978; 20:200–204.
14. Ory HW, The Women's Health Study. Ectopic pregnancy and intrauterine contraceptive devices: New perspectives. *Obstet Gynecol* 1981; 57:137–144.
15. Romero R, Kadar N, Copel JA et al.: The effect of different human chorionic gonadotropin assay sensitivity on screening for ectopic pregnancy. *Am J Obstet Gynecol* 1985; 153:72–74.
16. Rubin GL, Peterson HB, Dorfman SF, et al: Ectopic pregnancy in the United States: 1970 through 1978. *JAMA* 1983; 249:1725–1729.
17. Sandberg EC, Pelligra R: The medical antigravity suit for management of surgically uncontrollable bleeding associated with abdominal pregnancy. *Am J Obstet Gynecol* 1983; 146:519–525.
18. Schneider J, Berger CJ, Cattell C: Maternal mortality due to ectopic pregnancy. *Obstet Gynecol* 1977; 49:557–561.
19. Timonen S, Nieminen U: Tubal pregnancy, choice of operative method of treatment. *Acta Obstet Gynecol Scand* 1967; 46:327–339.
20. Tompkins PL: Preservation of fertility by conservative surgery for ectopic pregnancy. *Fertil Steril* 1956; 7:448–455.
21. Weinstein L, Morris MB, Dotters D, et al: Ectopic pregnancy—a new surgical epidemic. *Obstet Gynecol* 1983; 61:698–701.

21 Surgery of the Ovary

To care for a patient with ovarian disease, the surgeon must have appropriate training in gynecologic pathology and must be able to recognize the gross ovarian pathologic changes in situ to make proper surgical decisions. Close interaction between pathologist and gynecologist, careful consideration of the patient's reproductive wishes, and skillful application of modern techniques in surgery, chemotherapy, and irradiation therapy are required for optimal results. The basic concepts and surgical techniques for the care of ovarian surgical disease are outlined in this chapter.

Surgical Anatomy

The ovarian arteries are two of the three vessels providing significant blood supply to pelvic viscera that do not arise as branches of the internal iliac artery. The arteries to the ovary arise from the aorta, course downward, and divide into branches that enter the hilus of the ovary. The remaining portion of the ovarian artery continues to anastomose with the uterine arteries alongside the uterus.

The ovarian veins exit from the hilum of the ovary to form a pampiniform plexus that unites near the brim of the pelvis into two or three veins that subsequently join as they course upward. The veins from the ovary enter the inferior vena cava and the left ovary drains into the left renal vein. The lymph vessels of the ovary are joined by those situated in the periaortic area at the level of the renal artery.

The proximal ovary is attached to the uterus by the ovarian ligament. Its distal end is surrounded by the fallopian tube and the ovary itself lies between two folds of peritoneum called the meso-ovarian. The endocrine and reproductive activities of the ovary, its rich blood supply, and its exposed position in the abdominal cavity make it host to a myriad of pathologic conditions of inflammatory, metabolic, or neoplastic etiology. Detailed discussion of these numerous pathologic abnormalities and their gross and microscopic characteristics is beyond the scope of this text. The reader is referred to the Selected Bibliography for readings on this topic.

Preoperative Evaluation

The patient's history is of particular importance when the lesion is a functional cyst. Note the patient's last menstrual period, use of oral contraceptives, history of pelvic pain, previous pelvic inflammatory disease, use of an intrauterine contraceptive device, and other symptoms of the genitourinary and gastrointestinal systems. Likewise, historical data and symptoms suggesting the possibility of pregnancy, ascites, or abdominal distention are important.

In patients with ovarian cancer, Piver et al observed abdominal distention as the initial symptom in 44% of patients and pelvic or abdominal pain in 33%; 15% of patients had no symptoms and the mass was detected on routine pelvic examination.[43]

On pelvic examination note the size of the lesion, its mobility, the presence of tenderness or nodularity, and the condition of the opposite ovary. Obtain a Papanicolaou smear and a sampling of the uterine cavity to determine the possible presence of coexistent uterine malignancy.

Sonography is useful in the evaluation of suspected ovarian masses. Lawson and Albaretti reported observations in 251 cases of suspected pelvic masses studied by gray scale ultrasonography.[33] The presence or absence of a mass, its consistency, and its location were indentified correctly in 91% of patients. Most inaccuracies were associated with a misreading of the distended loops of bowel and errors in technique. Diagnostic errors were also more common at the lower limits of the resolution of the technique. Though anechoic lesions have a high likelihood of being benign tumors and extremely echogenic lesions usually represent benign teratomas, there is no way of distinguishing between benign and malignant disease with acceptable accuracy when mixed echogenicity is noted.[37] Relying upon sonography for an histologic diagnosis is unacceptable.

Review of the usefulness of liver and spleen scans on the author's service has shown them to be unreliable in the evaluation of ovarian malignancy.

A lymphangiogram is particularly useful in suspected cases of dysgerminoma, and computerized tomography (CT) is sometimes useful in the evaluation of periaortic nodal disease.

Chest x-ray study, intravenous pyelogram, barium enema, and proctoscopic examination are recommended in the evaluation of all ovarian masses except those associated with pregnancy and those mobile cystic masses in which irradiation of the young patient's ovaries would be unlikely to provide data valuable enough to merit the irradiation.

The surgeon must be constantly aware of the high incidence of metastatic cancer of the ovary presenting as a primary lesion in the older patient. A thorough preoperative evaluation of other sites for possible malignancies is recommended where metastasis is suspected. An upper gastrointestinal series, a mammography study, and cystoscopic examination are indicated.

Two groups of laboratory studies are currently prominent in the literature.[14] The first is a chemical profile consisting of urinary nonesterified cholesterol, plasma placental lactogen, and chorionic gonadotropin. These levels are often elevated in ovarian cancer: 72% of patients have high plasma placental lactogen levels and 45% have high human chorionic gonadotropin levels. There is little correlation between blood levels and the disease course, and the current clinical usefulness of these studies is limited.

The second group of studies consists of tests of tumor-associated antigens. These have been investigated since 1930, and three are currently of interest. Carcinoembryonic antigen, α-fetoprotein, and ovarian cystadenocarcinoma antigen have recently been studied by several investigators. Bast reported a 93% correlation between rising or falling levels of CA125 (an antigen common to most nonmucinous epithelial carcinomas) and progression or regression of disease.[10] Though the antigen assay may be useful in following response to therapy, a negative value does not correlate with absence of disease. The development of a reliable tumor marker for ovarian cancer would revolutionize the current management of such cancers.

Laparoscopy is most helpful in the evaluation of adnexal masses, particularly in young patients; but if a clear-cut indication for laparotomy is present, laparoscopy is an unnecessary prolongation of the preoperative evaluation.

Following the preoperative clinical evaluation, laparotomy is performed if any one of the following conditions exists.[26]

1. Any solid ovarian neoplasm.
2. Palpable ovary in a premenarchal or postmenopausal female.
3. Any ovarian cyst over 5 cm in size followed through at least one menstrual cycle but not responding to suppressive therapy.
4. Any ovarian cyst less than 5 cm in diameter that has persisted through three menstrual cycles.
5. Signs and symptoms that suggest torsion or rupture of an ovarian cyst producing an acute abdomen.
6. Any ovarian cyst that causes pain severe enough to interfere with normal activities
7. Unexplained ascites.

Operative Technique

The most important diagnostic test in an ovarian mass meeting the criteria for laparotomy is the laparotomy itself. Laparotomy must not be compromised by an inadequate incision. The surgeon should carefully observe any fixation or adhesions of the mass, note the presence or absence of ascites, and obtain peritoneal fluid for cytologic study; if no peritoneal fluid is present, peritoneal washings are performed. A biopsy specimen of the omentum is obtained and the omentum is excised in the presence of ovarian malignancy. A careful exploration is made of the liver and peritoneal gutters as well as of the pelvic and aortic lymph nodes, kidneys, large and small bowel, pancreas, stomach, and diaphragm. If malignancy is present, a total abdominal hysterectomy and bilateral salpingo-oophorectomy with removal of the omentum and all gross cancer is indicated.

A histologic classification of ovarian tumors is presented in Table 21-1; a system of surgical staging for carcinoma of the ovary is given in Table 21-2.

Choice of Incision

In the young patient with a freely movable cystic mass and a high probability of this mass being benign on tissue examination, a Pfannenstiel-type transverse incision is adequate. Mobile cystic masses can be easily elevated into the wound and adequately exposed without difficulty. In all other patients with adnexal masses, make a midline incision capable of being extended to the xyphoid.

The operative permit must allow for a wide latitude of procedures such as bowel resection, temporary or permanent colostomy, and pelvic or periaortic node biopsy. Thorough bowel preparation, including mechanical cleansing,

TABLE 21-1. Histologic Classification of Ovarian Tumors (World Health Organization)

- I. Common "epithelial" tumors
  - A. Serous tumors
    - 1. Benign
      - a. Cystadenoma and papillary cystadenoma
      - b. Surface papilloma
      - c. Adenofibroma and cystadenofibroma
    - 2. Of borderline malignancy (carcinomas of low malignant potential)
      - a. Cystadenoma and papillary cystadenoma
      - b. Surface papilloma
      - c. Adenofibroma and cystadenofibroma
    - 3. Malignant
      - a. Adenocarcinoma, papillary adenocarcinoma, and papillary cystadenocarcinoma
      - b. Surface papillary carcinoma
      - c. Malignant adenofibroma and cystadenofibroma
  - B. Mucinous tumors
    - 1. Benign
      - a. Cystadenoma
      - b. Adenofibroma and cystadenofibroma
    - 2. Of borderline malignancy (carcinomas of low malignant potential)
      - a. Cystadenoma
      - b. Adenofibroma and cystadenofibroma
    - 3. Malignant
      - a. Adenocarcinoma and cystadenocarcinoma
      - b. Malignant adenofibroma and cystadenofibroma
  - C. Endometrioid tumors
    - 1. Benign
      - a. Adenoma and cystadenoma
      - b. Adenofibroma and cystadenofibroma
    - 2. Of borderline malignancy (carcinomas of low malignant potential)
      - a. Adenoma and cystadenoma
      - b. Adenofibroma and cystadenofibroma
    - 3. Malignant
      - a. Carcinoma
        - i. Adenocarcinoma
        - ii. Adenoacanthoma
        - iii. Malignant adenofibroma and cystadenofibroma
      - b. Endometrioid stromal sarcomas
      - c. Mesodermal (müllerian) mixed tumors, homologous and heterologous
  - D. Clear cell (mesonephroid) tumors
    - 1. Benign: adenofibroma
    - 2. Of borderline malignancy (carcinomas of low malignant potential)
    - 3. Malignant: carcinoma and adenocarcinoma
  - E. Brenner tumors
    - 1. Benign
    - 2. Of borderline malignancy (proliferating)
    - 3. Malignant
  - F. Mixed epithelial tumors
    - 1. Benign
    - 2. Of borderline malignancy
    - 3. Malignant
  - G. Undifferentiated carcinoma
  - H. Unclassified epithelial tumors
- II. Sex cord stromal tumors
  - A. Granulosa—stromal cell tumors
    - 1. Granulosa cell tumor
    - 2. Tumors in the thecoma-fibroma group
      - a. Thecoma
      - b. Fibroma
      - c. Unclassified

TABLE 21-1. *(Continued)*

- B. Androblastomas; Sertoli–Leydig cell tumors
  - 1. Well differentiated
    - a. Tubular androblastoma; Sertoli cell tumor (tubular adenoma of Pick)
    - b. Tubular androblastoma with lipid storage; Sertoli cell tumor with lipid storage (folliculome lipidique of Lecene)
    - c. Sertoli–Leydig cell tumor (tubular adenoma with Leydig cells)
    - d. Leydig cell tumor; hilus cell tumor
  - 2. Of intermediate differentiation
  - 3. Poorly differentiated (sarcomatoid)
  - 4. With heterologous elements
- C. Gynandroblastoma
- D. Unclassified

III. Lipoid (lipoid) cell tumors

IV. Germ cell tumors
- A. Dysgerminoma
- B. Endodermal sinus tumor
- C. Embryonal carcinoma
- D. Polyembryoma
- E. Choriocarcinoma
- F. Teratomas
  - 1. Immature
  - 2. Mature
    - a. Solid
    - b. Cystic
      - i. Dermoid cyst (mature cystic teratoma)
      - ii. Dermoid cyst with malignant transformation
  - 3. Monodermal and highly specialized
    - a. Struma ovarii
    - b. Carcinoid
    - c. Struma ovarii and carcinoid
    - d. Others
- G. Mixed forms

V. Gonadoblastoma
- A. Pure
- B. Mixed with dysgerminoma or other form of germ cell tumor

VI. Soft tissue tumors not specific to ovary

VII. Unclassified tumors

VIII. Secondary (metastatic) tumors

IX. Tumor-like conditions
- A. Pregnancy luteoma
- B. Hyperplasia of ovarian stroma and hyperthecosis
- C. Massive edema
- D. Solitary follicle cyst and corpus luteum cyst
- E. Multiple follicle cysts (polycystic ovaries)
- F. Multiple luteinized follicle cysts and/or corpora lutea
- G. Endometriosis
- H. Surface-epithelial inclusion cysts (germinal inclusion cysts)
- I. Simple cysts
- J. Inflammatory lesions
- K. Parovarian cysts

antibiotics and vitamin K, is indicated with large or fixed masses (Chapter 22).

One must be aware of the upper abdominal pathology in ovarian cancer. Piver found 83% of ovarian cancer patients referred to him postoperatively had an incision inadequate for upper abdominal exploration.[43] Piver et al reviewed laparoscopic findings in previously treated patients with stage I ovarian cancers: 11% had diaphragmatic metastasis, 13% aortic lymph node

TABLE 21-2. Staging of Primary Carcinoma of the Ovary[a] (International Federation of Gynecologists and Obstetricians)

Stage	Characteristic
I	Growth limited to the ovaries
a	Growth limited to one ovary; no ascites
i	No tumor on the external surface; capsule intact
ii	Tumor present on the external surface and/or capsule ruptured
b	Growth limited to both ovaries; no ascites
i	No tumor on the external surface; capsules intact
ii	Tumor present on the external surface and/or capsule(s) ruptured
c	Tumor either stage Ia or stage Ib, but with ascites* present or positive peritoneal washings
II	Growth involving one or both ovaries with pelvic extension
a	Extension and/or metastases to the uterus and/or tubes
b	Extension to other pelvic tissues
c	Tumor either stage IIa or stage IIb, but with ascites* present or positive peritoneal washings
III	Growth involving one or both ovaries with intraperitoneal metastases outside the pelvis and/or positive retroperitoneal nodes
	Tumor limited to the true pelvis with histologically proven malignant extension to small bowel or omentum
IV	Growth involving one or both ovaries with distant metastases
	If pleural effusion is present there must be positive cytology to allot a case to stage IV
	Parenchymal liver metastases equals stage IV
Special category	Unexplored cases that are thought to be ovarian carcinoma

[a] Based on findings at clinical examination and surgical exploration. The final histology after surgery is to be considered in the staging, as well as cytology as far as effusions are concerned.

* Ascites is peritoneal effusion which in the opinion of the surgeon is pathological and/or clearly exceeds normal amounts.

metastasis, 8% pelvic lymph node metastasis, 3% omental metastasis, and 32% positive peritoneal washings.[42]

An adequate incision is an absolute prerequisite for operating on the pelvic mass that may be an ovarian cancer. Not only is the incision important for surgical excision, but, in addition, subsequent follow-up treatment programs will be based on the findings of the original laparotomy. Careful, thorough abdominal surgery and detailed, precise recording of the intraoperative findings are vital for the care of the patient with this devastating disease.

Unilateral Benign Ovarian Tumors

The gross characteristics of benign ovarian tumor are a smooth capsule, cystic mass, unilateral location, mobility, lack of adhesions, no excrescences or solid areas palpable through the cyst, the absence of ascites, and a negative abdominal exploration. When such gross characteristics are present and the patient wishes to maintain fertility, cystectomy (Fig. 21-1), oophorectomy (Fig. 21-2), or salpingo-oophorectomy (Figs. 21-3 through 21-6) is performed, depending on the size of the tumor. Excise the specimen intact and give it to the pathologist. If the diagnosis suggests the possibility of bilateral disease such as serous cystadenoma, the opposite ovary is biopsied. If the diagnosis is dermoid, the biopsy can be omitted in the contralateral ovary if it appears grossly normal.[44] Every effort is made during the ovarian biopsy to avoid unnecessary trauma to the remaining ovary and to minimize ovarian and peritubal adhesions.

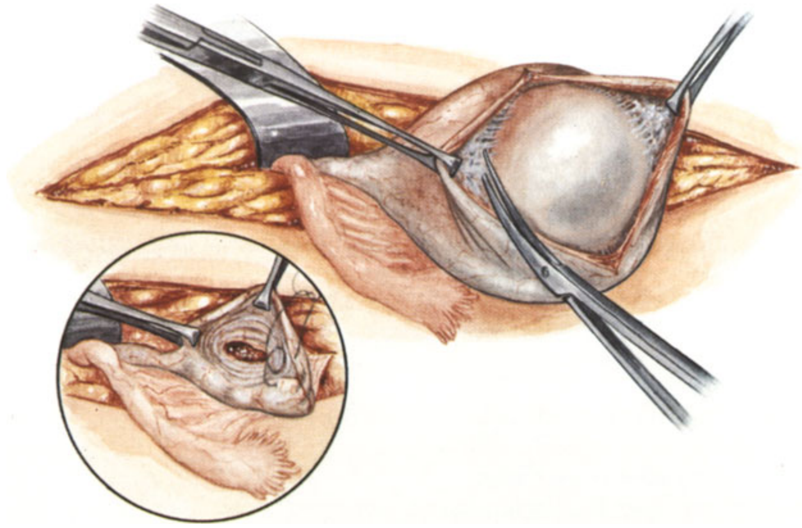


FIGURE 21-1. Cystectomy. In the patient with a simple ovarian cyst, grasp the ovary between the thumb and index finger. Using a No. 15 blade, make an incision through the fibrous ovarian capsule overlying the cyst. Grasp the fibrous wall with intestinal Allis clamps and pull laterally. With fine Metzenbaum scissors, dissect the areolar tissue that lies between the cyst wall and the ovarian capsule. Attempt to excise this structure intact and give it to the pathologist. If there is any evidence that malignancy exists, do not attempt this type of excision. *Inset:* Close the ovarian defect with one or two layers of far-and-near stitches going through the ovary and grasping the edges to approximate the ovary. Use swaged intestinal needles and 3–0 or 4–0 absorbable suture.

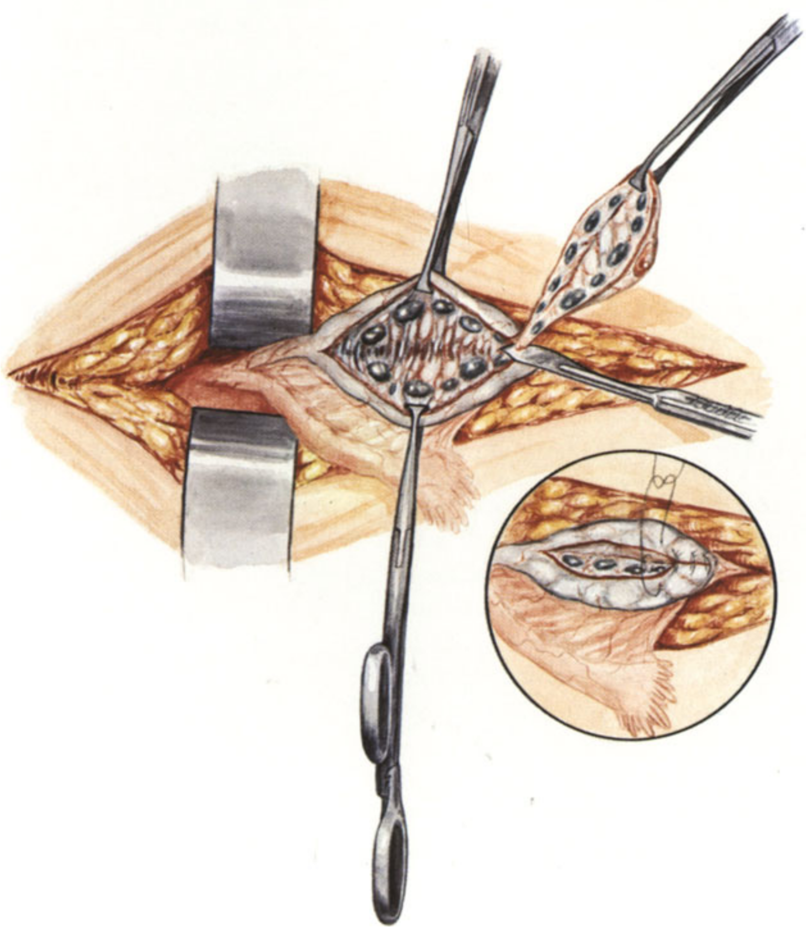


FIGURE 21-2. Oophorectomy. Expose the ovary and grasp the meso-ovarium with the left hand. Using a No. 15 blade, incise a wedge of tissue which extends well into the hilum of the ovary. This procedure is useful in Stein-Leventhal syndrome and to rule out the presence of malignancy in the opposite ovary. *Inset:* Make a parallel incision and excise the wedge of ovarian tissue. Place intestinal Allis clamps on the edge and close the defect with modified far-and-near sutures of 3–0 or 4–0 absorbable suture.

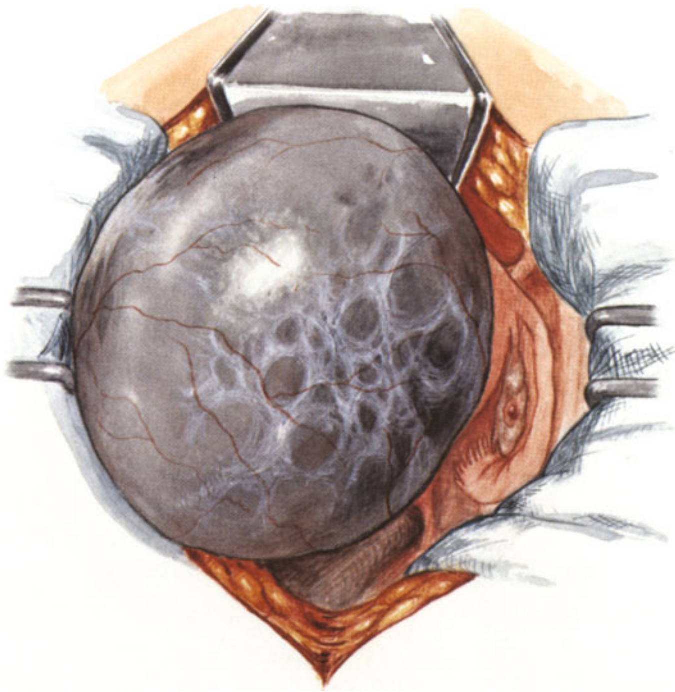


FIGURE 21-3. Salpingo-oophorectomy. Mobilize the large ovarian mass into the wound, freeing any adhesions to adjacent viscera. Unless the pedicle is very long, the retroperitoneal approach is the best and produces fewer problems with bleeding.

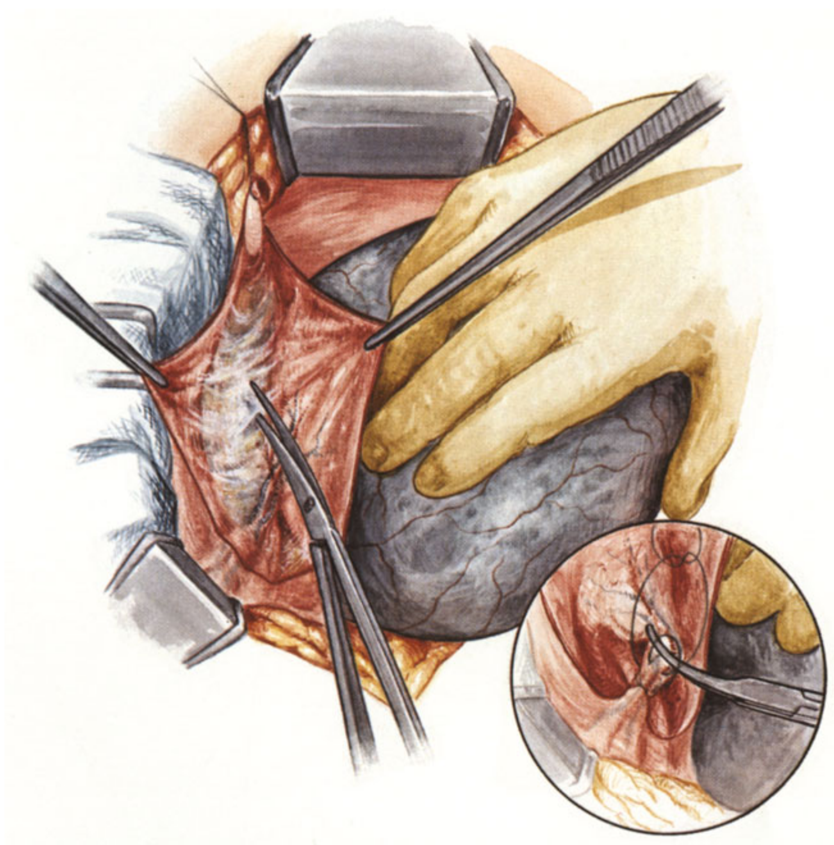


FIGURE 21-4. Cut the round ligament and secure it with a 3–0 suture. Incise sharply back over the psoas muscle using fine Metzenbaum scissors. Grasp the cut edges with Adson-Brown thumb forceps and pull laterally. Identify the ureter as it lays on the medial fold of the peritoneum coursing up toward the ovary as well as the ovarian vessels. *Inset:* Pass a 2–0 absorbable suture around the ovarian vessels and ligate them. Place a curved Masterson clamp proximally toward the ovary and place a transfixation suture of 2–0 absorbable through the ovarian vessels between the clamp and the free tie. Cut the ovarian vessels.

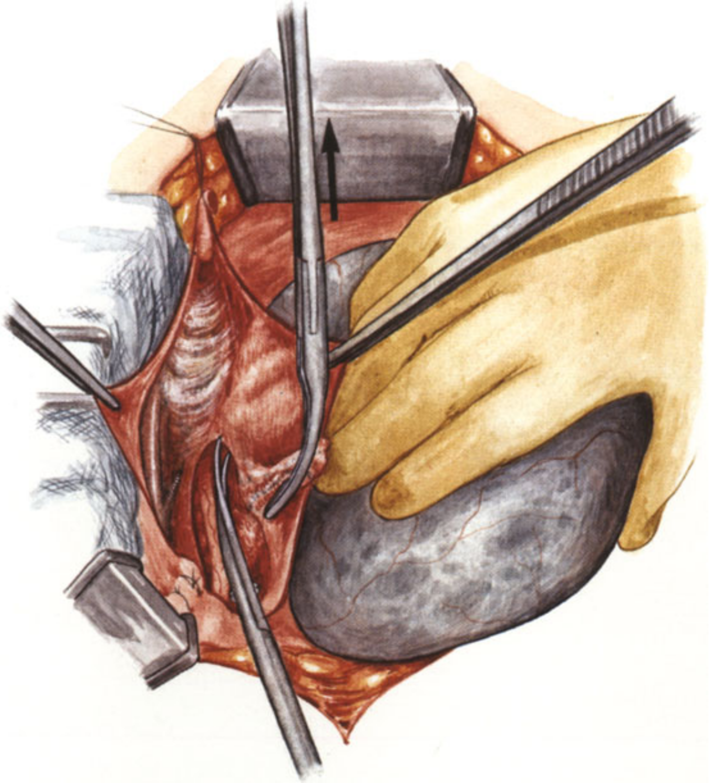


FIGURE 21-5. Using the ovarian vessels for traction, cut the peritoneum parallel to the ureter while applying traction to the ovarian mass and elevating it out of the pelvis. Avoid placing large clamps where the ureter cannot be clearly visualized. Small bleeders are secured with 3–0 absorbable ties or small clips.

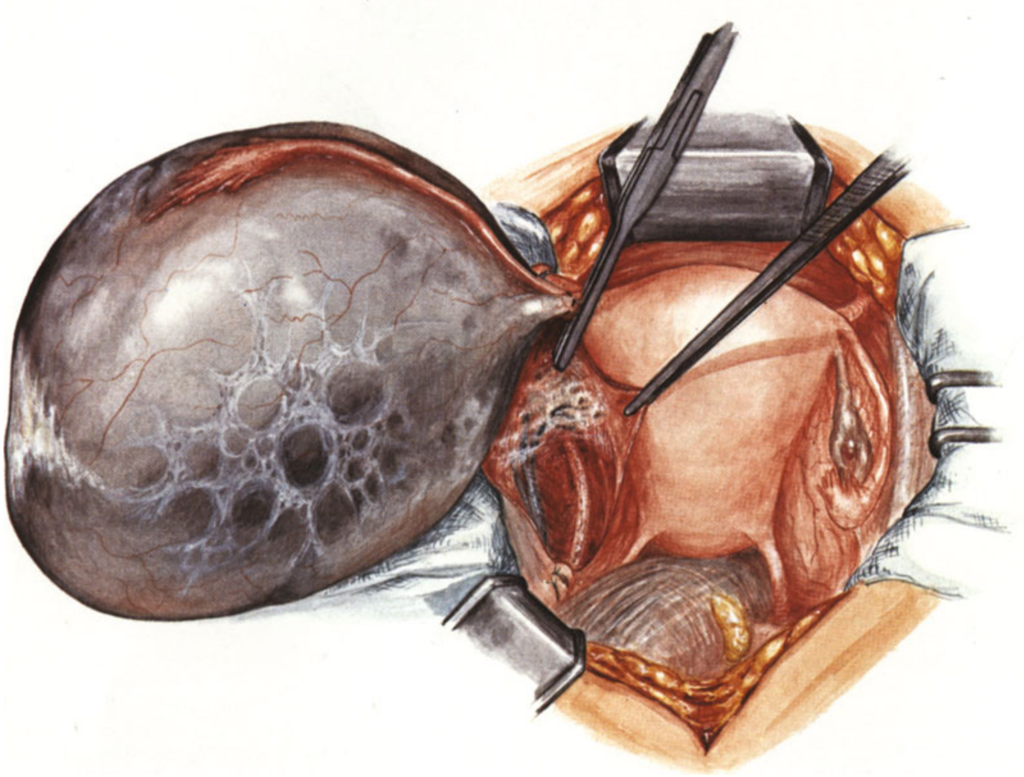
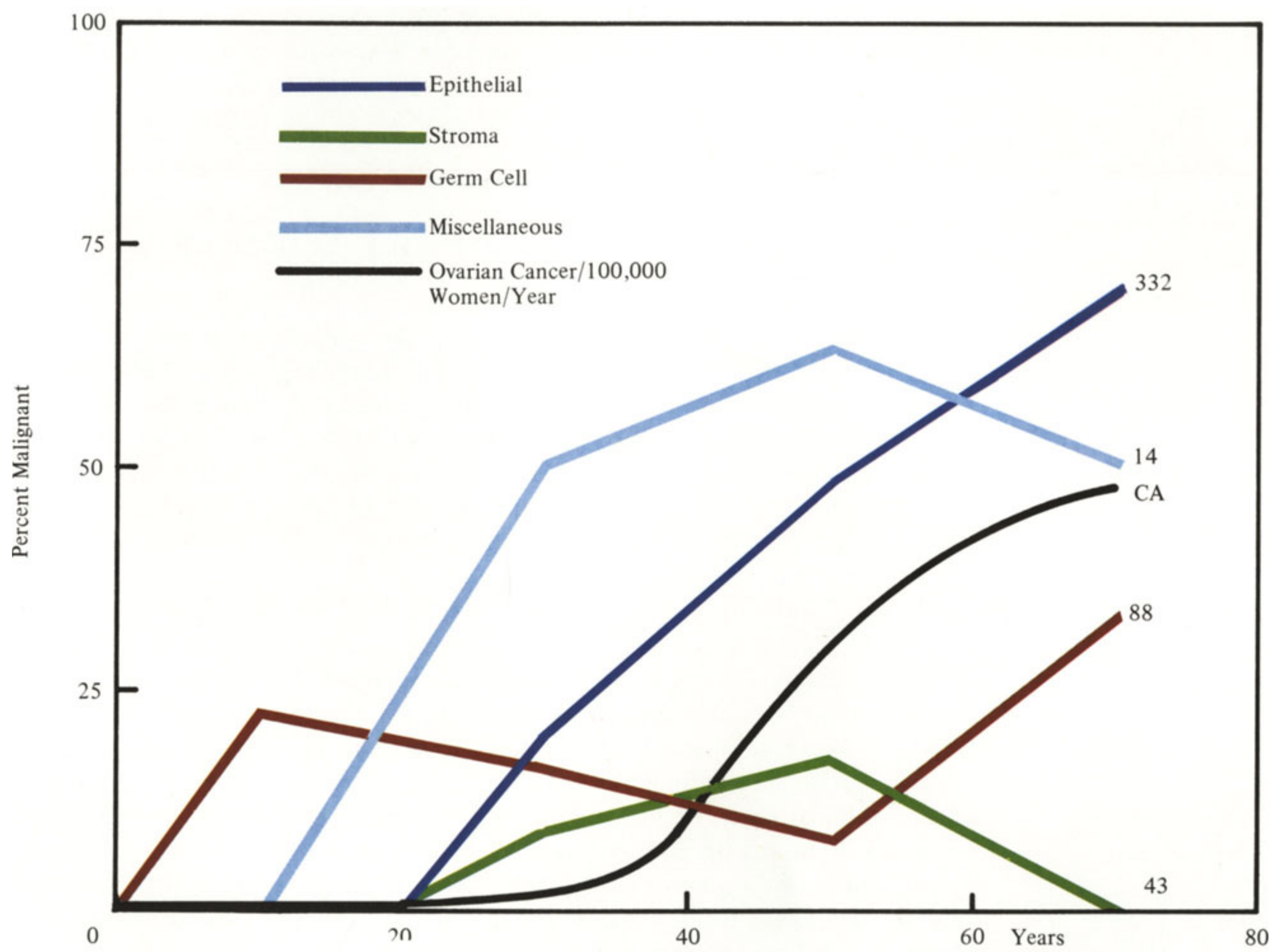


FIGURE 21-6 Once the mass is mobilized out of the pelvis, place Masterson clamps across the utero-ovarian vessels and the tube and excise the mass from the pelvis. Secure hemostasis of the ovarian vessels with a 2–0 absorbable suture. Close the peritoneal defect with a continuous 3–0 absorbable suture taking care to avoid the ureter. Avoid placing any sutures above the ligated ovarian vessels as this is a pampiniform plexus of veins and any puncture will produce hematoma above the ligature.

One must maintain perspective in evaluating adnexal masses. There are no physiologic adnexal masses in premenarchal and postmenopausal women. In women in the reproductive years, 95% of palpable adnexal masses are physiologic ovarian cysts. These cystic masses require no specific treatment and will resolve during observation for a span of two menses.[44]

In a study of young women with palpable adnexal masses that did not resolve, Ranney and Chastain found 66 endometriomas, 43 tubal pregnancies, 30 paramesonephric cysts, 22 polycystic ovaries, 12 pyo- and hydrosalpinx, and 11 physiologic cysts; there were 24 dermoid tumors, 19 serous cystadenomas, 7 mucinous cystadenomas, and 7 fibroids.[44] Malignant ovarian neoplasms rarely occur in the early reproductive years; therefore, one must blend a healthy conservatism in this group with aggressive investigation and therapy in the older patients (Fig. 21-7).



Percent Malignant by Age and Type

FIGURE 21-7. Types of ovarian neoplasms seen in a 10-year period at the University of Kansas Medical Center plotted according to age and percentage malignant. The total number of each type is noted at the right. The extreme rarity of ovarian tumors under the age of 20 is evident, as is the absence of epithelial neoplasm in this group. The increase in ovarian cancer incidence per 100,000 women is also plotted and parallels the increase in epithelial neoplasms, which comprise 80% of such cancers. Adapted from Masterson BJ, Smith S: Review of 447 ovarian tumors (*unpublished data*) and Cramer DW, Cutler SJ: *Am J Obstet Gynecol* 1974; 118:443–460.

Residual Ovarian Syndrome

An occasional patient will be seen who has had hysterectomy with one or both ovaries still present and a pelvic mass. Many have pelvic pain, but some are asymptomatic. Operative findings include extensive adhesions between the ovary and adjacent viscera.[15] The ureter and sometimes the iliac vessels may be pushed medially by this cystic retroperitoneal mass. Take care in the dissection and be sure to visualize the ureter, as it will be hard to palpate in the scar tissue. Most ovaries will contain follicle cysts or corpus luteum and the malignancy rate is 3% to 10%.[15] To avoid this situation, remove the ovaries in the patient over 40 or suspend them well out of the pelvis if they are left in the younger patient.

Bilateral Benign Tumors

The same pathologic characteristics may be present bilaterally. If the patient wishes to maintain fertility, remove the most involved ovary for frozen section study. If the tumor is histologically benign, resect the benign disease from the less involved ovary. Blum and Meidan followed this plan of management in 18 patients.[11] Menstrual function was present in 17 patients; 9 conceived and delivered within 3 years of surgery. Most of the tumors in the series were bilateral dermoid cysts.

Pelvic Inflammatory Disease and Tuboovarian Abscess

Ninety percent of patients with acute pelvic inflammatory disease (PID) respond to antibiotic therapy. In the study of Cunningham et al, 92% became asymptomatic four days after either tetracycline or penicillin treatment for acute PID.[17] In addition, some patients will require drugs active against anaerobic bacteria or gram-negative aerobes, intravenous fluids, and bed rest.

Approximately 5% of patients with acute PID develop abscess formation. This abscess may lie outside the tube, be of tuboovarian location, or consist of a pyosalpinx. Conservative therapy consisting of inpatient management, antibiotics, and fluids is recommended. Where the diagnosis is uncertain, laparoscopy is indicated.

Approximately 30% of pelvic abscesses merit colpotomy drainage. The requirements for colpotomy drainage are midline location of the abscess with fluctuation of the contents, surgical accessibility via the cul-de-sac, and obliteration of adjacent peritoneum to avoid drainage of the abscess contents into the peritoneal cavity (which produces generalized peritonitis.)[24] Ulhrich and Sanders discussed the sonographic characteristics of pelvic masses.[52] The predominantly unilocular abscess is effectively drained vaginally by dissecting the rectovaginal septum, whereas the multilocular abscess, usually at a distance from the midline of the pelvis, is difficult to drain. In patients in whom colpotomy drainage cannot be established, abdominal exploration is indicated if increasing rebound tenderness, increasing abscess size, a failure to defervesce, and abdominal rigidity occur.

Immediate exploration is indicated in those patients in whom rupture of the abscess is suspected. Symptoms of rupture include severe pain, often in the left lower abdomen, increasing signs and symptoms in the upper abdomen, and pain on examination. Diarrhea, chills, a rapid pulse, and ileus are the signs of ruptured tuboovarian abscess. An elevated temperature is usually not observed.[18]

Daly and Monif note that 70% of patients survive if brought to surgery within 12 hours of the time of rupture, whereas 80% die if surgery is not promptly performed.[18] If no surgical intervention is undertaken, 100% of patients die.

Ten percent of patients with pelvic abscess need early surgical intervention, and in general that procedure should consist of total abdominal hysterectomy and bilateral salpingo-oophorectomy. Examine the pelvic veins for suppurative pelvic thrombophlebitis and, if present, ligate them very high and administer anticoagulants.

Unilateral salpingo-oophorectomy is acceptable in the patient who has a strong desire for children and whose contralateral adnexa appears normal on gross examination. Hager reported a higher pregnancy rate (80%) in patients with a unilateral tuboovarian abscess treated with unilateral salpingo-oophorectomy when compared with those patients treated with antibiotic therapy alone (25%).[27] The patient must understand that as many as 20% of patients with pelvic abscess are subject to more extensive surgery due to persistent PID or associated symptoms.

Stein-Leventhal Syndrome

Oligomenorrhea or amenorrhea, ovulatory failure, hirsutism, and sometimes obesity associated with bilateral polycystic ovaries with a fibrous capsule comprise the Stein-Leventhal syndrome.[50] Endocrine studies usually show elevated plasma testosterone, androstenedione, and sometimes 17-ketosteroid levels. Plasma luteinizing hormone is elevated, whereas follicle-stimulating hormone is consistently low.[34] Laparoscopy will confirm the diagnosis and sonography can demonstrate the ovarian changes as well.

Clomiphene citrate produces ovulation in the majority of patients.[21] Should clomiphene not produce a prompt response, wedge resection is suggested, as it produces a return of ovulatory function in 95% of patients and most who desire to can become pregnant.[50] More recently, Hjortrup et al reported a 90% return of normal menstrual cycles after ovarian wedge resection. Normal pregnancies resulted in 100% of those patients with normal postoperative menstrual cycles who desired pregnancy.[31] Babaknia et al reported 28 ovarian tumors and 36 other pelvic lesions in 181 cases of Stein-Leventhal syndrome, calling attention to the need for exploration and microscopic study of palpable pelvic masses in this condition if the laparoscopic appearance is at all atypical.[6] The surgeon is reminded that pelvic adhesions occur following a surgical procedure in the lower abdomen and pelvis; therefore, special attention to surgical technique is recommended to minimize pelvic adhesions following wedge resection, as the adhesions may lead to infertility. Weinstein and Polishuk studied 57 patients who had an ovarian wedge resection and observed that 14% developed pelvic adhesions that resulted in infertility.[53]

Malignant Tumors Amenable to Unilateral Salpingo-Oophorectomy

Epithelial Lesion

The borderline epithelial lesion that is unilateral and encapsulated may be managed with unilateral salpingo-oophorectomy when reproductive capabilities are an overriding concern.[20] The difficulty in treating this lesion lies in obtaining a final diagnosis of borderline status at the time of surgery. Likewise, one may manage stage Ia well-differentiated grade I epithelial tumors that are unilateral and encapsulated the same way. Williams and Dockerty reported 65 patients with low-grade epithelial malignancies of the ovary: 26 patients had mucinous cystadenocarcinoma, 25 serous cystadenocarcinoma, and 14 endometroid carcinoma.[57] No deaths from malignancy of the ovary resulted in the entire group of patients with unilateral intracystic, grade I cancer. In the contralateral ovary, 31% of patients had serous ovarian tumors and 14% had malignant tumors. Therefore, frozen section must confirm a normal contralateral ovary, even one grossly normal in appearance.

The criteria for conservative management of epithelial ovarian tumors are as follows: occurrence in a patient under 35 years of age, intracystic location, unruptured, nonadherent, of low grade, and opposite ovary uninvolved by the tumor process on microscopic examination. As only 8% of epithelial tumors occur in women under 40,[9] these criteria are rarely met; however, approximately 50% of patients will achieve pregnancy if some ovarian tissue can be left behind.

Germ Cell Tumors

Germ cell tumors are amenable to unilateral salpingo-oophorectomy in two specific types of tumors: dysgerminoma and mature teratoma. The dysgerminoma must be under 10 cm in size, unilateral, well-encapsulated, and without metastasis or mixed elements. When the lesion does not meet these criteria, total abdominal hysterectomy, bilateral salpingo-oophorectomy, and irradiation therapy are indicated.[1] Unilateral salpingo-oophorectomy as the initial surgical treatment does not significantly change the 10-year postoperative survival rate.[4]

Although cystic mature teratomas have a 2% malignancy rate,[51] if the teratoma is well-encapsulated, unilateral salpingo-oophorectomy is acceptable. Most cases of cystic mature teratomas are unilateral and occur during the reproductive years. Stamp et al noted in their series of patients with malignancies arising from cystic teratomas that the average age was 54—approximately a decade or more later than patients with benign ovarian teratomas.[49]

All reported cases of solid mature teratomas have been unilateral, hence well-encapsulated lesions may be treated with unilateral salpingo-oophorectomy.[51] Gershenson et al advise that in young patients with stage I endodermal sinus tumors who have not completed childbearing, unilateral salpingo-oophorectomy and thorough staging biopsies and washings provide adequate surgical management. In their series, no case of bilateral ovarian involvement was noted. Following postoperative combination chemotherapy, three patients have undergone five normal pregnancies. The authors recommend monthly α-fetoprotein levels throughout the course of chemotherapy and for 1 year after discontinuation.[25]

Stromal Tumors, Granulosa Cell Carcinoma, and Sertoli-Leydig Tumors

These tumors, which are unilateral and encapsulated, permit the preservation of the opposite ovary as they are rarely bilateral.[54] Remember that as many as 20% of granulosa cell tumors have associated endometrial cancer; therefore, uterine curettage is essential for an accurate diagnosis.

Bilateral Salpingo-Oophorectomy and Hysterectomy

Bilateral salpingo-oophorectomy and total abdominal hysterectomy are indicated in those patients with benign ovarian tumors who do not wish to preserve their fertility. When malignant tumor is present, a thorough abdominal exploration, total abdominal hysterectomy, bilateral salpingo-oophorectomy, omentectomy, and removal of all gross cancer consistent with good surgical judgment is standard therapy.

Parker et al observed statistically different long-term survival rates in patients with epithelial carcinoma of the ovary in whom the omentum was removed[40] (Figs. 21-8 and 21-9). A biopsy of the omentum should be done in all patients with possible malignant lesions of the ovary, and the omentum should be removed in all patients who receive definitive therapy for ovarian cancer. The details of omental vascular anatomy are reviewed by Alday and Goldsmith[2] (Fig. 21-10).

Place catheters for radioactive chromic phosphate (^{32}P) administration in patients with stage I epithelial malignancy of the ovary and give it in the immediate postoperative period (Figs. 21-11 and 21-12). Chromic phosphate has been shown to achieve approximately a 90% 5-year survival rate in stage I ovarian cancer. Chromic phosphate, which emits pure beta irradiation, is adequate to destroy small clusters of malignant cells. It has a maximum penetration of approximately 4 mm, and the isotope has a half-life of 14 to 15 days.[42] Administration is usually 10 μCi in 200-ml volume.

FIGURE 21-8. Omentectomy. Pull the colon downward at the upper end of the laparotomy wound into the field. Place a fiberoptic light source behind the omentum, transilluminating it. Identify the vessels seen, beginning from left to right; pull the omentum upward and divide it using hemoclips on the side proximal to the colon and a series of hemostats above the clips.

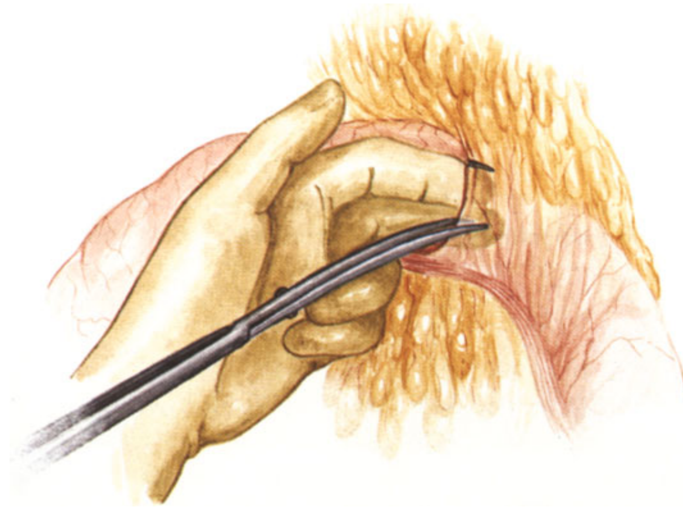


FIGURE 21-9. When the omentum is to be excised from the margins of the stomach, divide the filmy adhesions that attach the omentum to the colon by inserting the fingers in this cleavage plane. Using sharp dissection, completely free the omentum from the colon. Use hemoclips if any bleeding vessels are encountered. Pull the omentum down from the stomach; identify the gastroepiploic vessels and ligate them using hemoclips and a series of hemostats opposite the clipped vessels. Excise the rest of the omentum between the clips and hemostats. Avoid the underlying colonic vessels during this excision.

Hilaris and Clark reported survival rates of 92% in patients with stage I ovarian cancer who received ^{32}P and 77% in a similar group who did not.[29] Patients with ruptured tumors are also candidates for radiocolloid administration. If the diagnosis is in doubt, place catheters. Remove them if the pathologic diagnosis is benign.

External radiation of the pelvis in combination with intraperitoneal ^{32}P or chemotherapy is used in patients with stage II ovarian cancer in whom little tumor remains after surgery. Mansfield notes a 47% 5-year survival rate as opposed to 33% when no irradiation was given.[35] Shielding of the liver and kidney prevents therapeutic doses from reaching the common sites of spread in advanced ovarian cancer. Improved 5-year survival rates following total abdominal radiation using the moving strip technique may result from radiation of the previously shielded right hemidiaphragm.[19] Most treatment protocols emphasize surgery and chemotherapy for stage III ovarian disease.[20]

If the lesion is of the epithelial type, the administration of alkylating agents such as oral phenylalanine mustard 1 mg/kg in divided doses over a 5-day period once a month is appropriate. If the patient has a poorly differentiated lesion, or advanced lesions, more aggressive combination chemotherapy such as doxorubicin (Adriamycin) and cyclophosphamide (Cytoxan) is advised. Edwards et al[22] reported an overall response rate of 34.6 % in 153 patients with untreated advanced epithelial carcinoma. Therapeutic regimens consisted of either hexamethylmelamine, doxorubicin, and cyclophosphamide or melphalan and cisplatinum. There were 47 complete responders determined surgically. Response rate was significantly increased if the residual tumor was less than 2 cm in diameter. There was significant hematologic and gastrointestinal toxicity associated with combination chemotherapy.[22]

Patients with minimal residual disease have a better prognosis, and the surgeon must make every effort consistent with good surgical judgment to

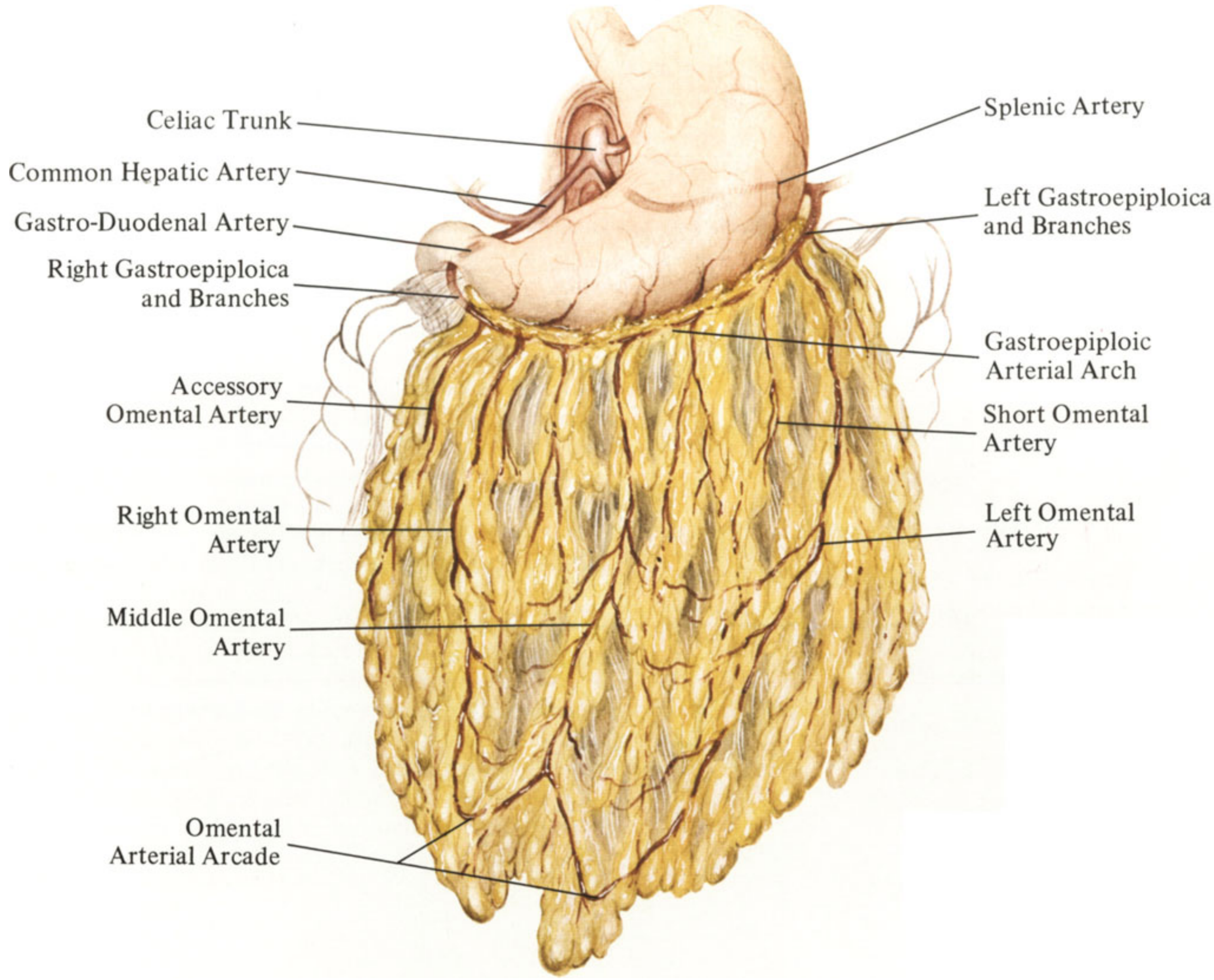


FIGURE 21-10. The blood supply to the omentum is shown. The arcades may be used to lengthen pedicles in grafts. Its rich blood supply makes the omentum useful to vascularize reconstructive procedures.

remove all resectable epithelial ovarian cancer.[12,40] It is difficult for a surgeon trained in the anatomic surgical technique of Halstead to debulk a patient with ovarian cancer and not feel it is meddlesome at best or destructive at worst. The importance of reductive surgery in prolonging survival has been emphasized by Smith and Day (Table 21-3)[48] (Figs. 21-13 and 21-14). If the surgeon is unprepared to perform extensive cytoreductive surgery, then the patient with a fixed adnexal mass should be referred.

Fisher reviewed modern laboratory data suggesting that tumor cells are released into the bloodstream very early in the natural development of a tumor, but are destroyed by the host's immunologic system until it is overcome.[23] Furthermore, although lymph nodes are effective at screening particulate matter, most tumor cells entering a lymph node do not stay localized. Thus, one has to consider the host as the unit involved, not the various components such as lymph or blood.[23]

Immunologic benefits from the removal of tumor bulk include the removal of serum-blocking factor,[28] increased cell-mediated immunity,[56] and increased release of lymphoblasts by regional nodes.[3] Although debulking does increase

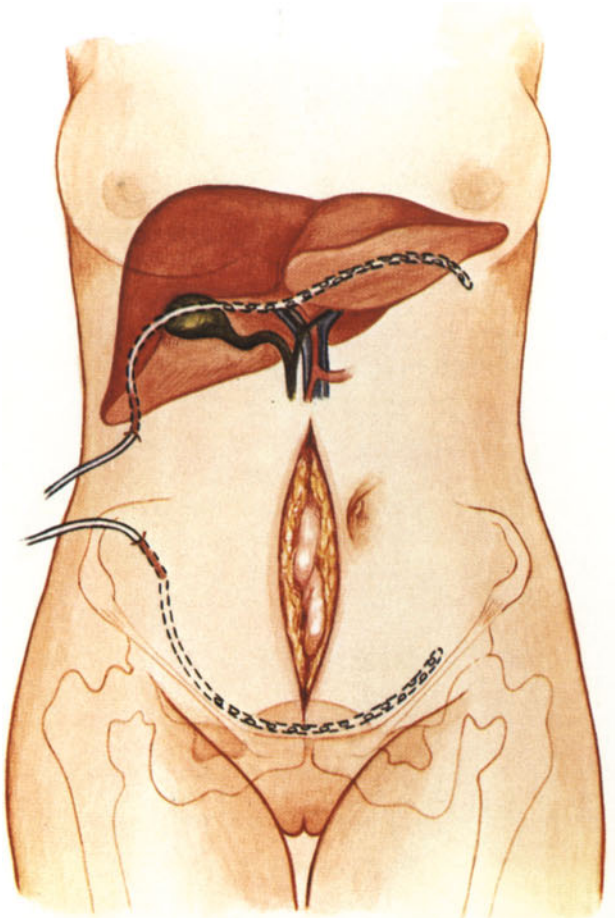


FIGURE 21-11. When administration of chromic phosphate is anticipated in the postoperative period, always insert radioisotope administration tubes. If the histologic diagnosis is in doubt, insert the tubes. If clinical indications are not present, their use causes little morbidity and they can be removed. Small or medium Hemovac tubes are adaptable by cutting two to three extra holes with sharp scissors, taking care not to weaken the structural integrity of the tube. Use a Hemovac needle and place the needles in a diagonal fashion through the abdominal wall to allow partial closure on removal of the tubes so that spill will be minimized. Take care to avoid the anastomosis between the superior and inferior epigastric vessels which can be palpated through the abdominal wall. Secure the tubes with braided nylon suture placed in a circular fashion 3 to 4 mm from the tube edge; leave the sutures untied and rolled in a gauze edge taped to the abdomen. The wound will be ready for closure on removal of the administration tubes. Lay the tubing into the abdomen.

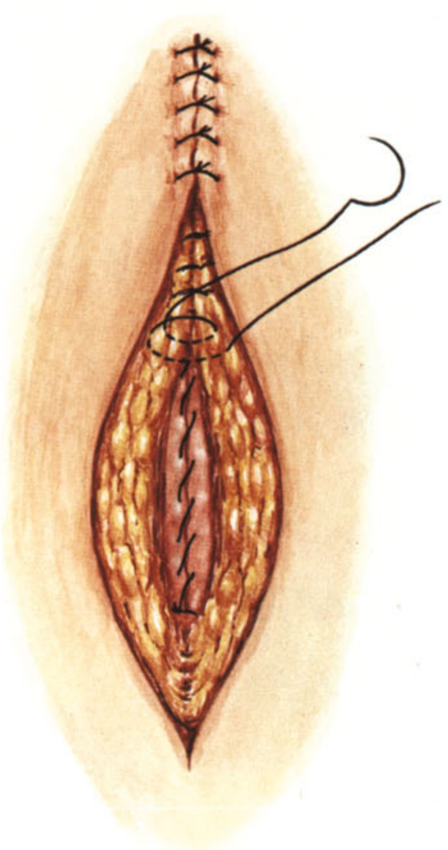


FIGURE 21-12. Wound construction is important when using chromic phosphate and differs from the usual wound closure. No drains can be used when chromic phosphate is to be administered; the peritoneal closure should be separate and differs from the usual far-and-near wound closure. Close the peritoneum with a continuous 2–0 absorbable suture, everting the edges and making the closure as watertight as possible. Place a separate far-and-near layer of 0 nylon sutures. Make certain the longer limb does not enter the peritoneum. Close the skin with interrupted 3–0 monofilament vertical mattress sutures.

TABLE 21-3. Percent Survival by Tumor Size and Postoperative Treatment at 5 Years

Residual tumor (cm)	Irradiation, %	Chemotherapy, %
None	70	67
0–1	52	32
1–2	15	16
3–6	12	4
7–9	0	0
10+	4	5

Adapted from Smith JP, Day TG.[48]

the proportion of growing tumor cells owing to improved blood and oxygen supply, these growing cells are more sensitive to chemotherapy and irradiation than resting cells.

Finally, when the tumor mass approaches a lethal volume, lymphocyte cytotoxicity is lost and host death follows.

These immunologic concepts are useful in the treatment of epithelial ovarian cancer, as most lesions are beyond complete surgical excision. Procedures must be tailored to decrease tumor burden so that host defense mechanisms and adjunctive therapy may be effective.[32] The operations are in no way anatomic, as microscopic tumor is usually present. They are useful now and will become increasingly more effective as adjunctive measures improve.

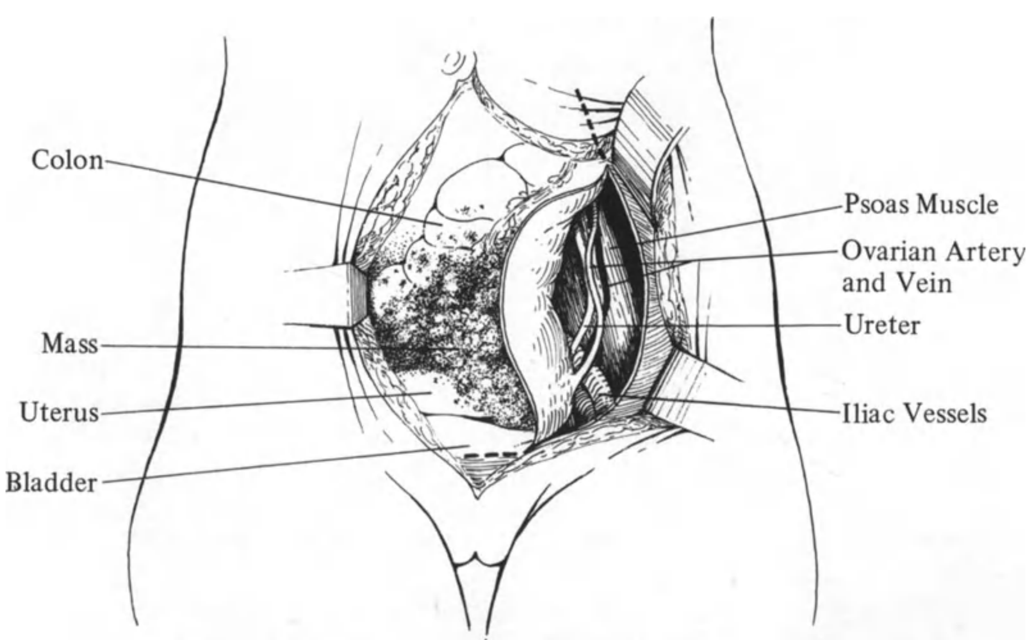


FIGURE 21-13. When the ovarian tumor involves pelvic peritoneum or is fixed in the pelvis, a retroperitoneal extension of the incision laterally from the round ligaments will usually provide additional exposure. The white line lateral to the colon is an easy point of entry. The ovarian vessels must be ligated; the iliac vessels protected; and the ureter dissected free of the mass under direct vision. No attempt at peritonealization of the large peritoneal defect produced should be attempted.

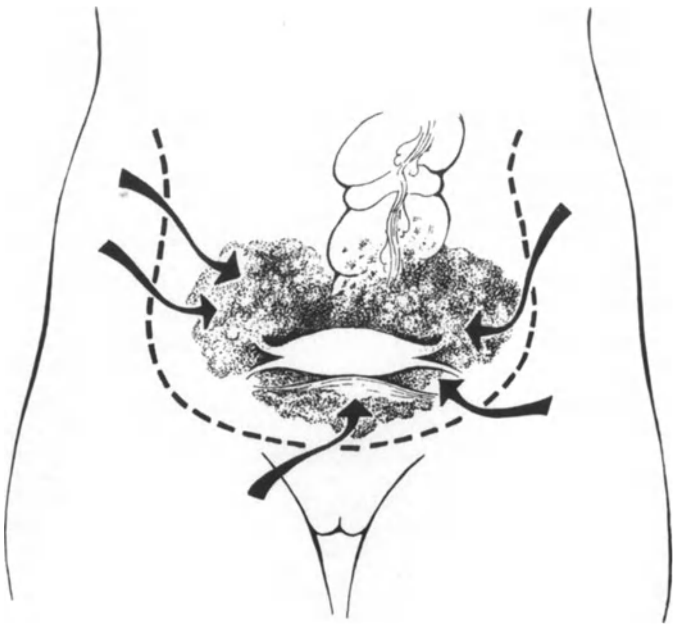


FIGURE 21-14. Additional retroperitoneal avenues of dissection are shown. Extension downward into the pararectal and paravesical spaces further defines the pelvic blood supply.

Second-Look Procedure

The second-look operation is an exploratory laparotomy that is performed at some time following the initial therapeutic surgical procedure for ovarian cancer. The concept is not new but its precise role in the surgical management of ovarian cancer remains to be defined.

The operation is useful in approximately 1 of 10 patients with advanced epithelial cancer of the ovary. Its primary use is to obtain information as to the state of disease in a patient in whom little disease is palpable. The patient should have had the original surgery at least 1 year before, received at least 1 year of chemotherapy, and clinically responded to such therapy by a marked decrease in the size of the residual disease.

Unfortunately, the majority of patients with a postoperative response to chemotherapy have clinically detectable tumor; however, approximately 50% of patients who had all visible disease resected initially are found free of disease at second-look surgery. Patients with massive unresectable disease prior to chemotherapy rarely have negative second-look results.[45] An adequate second-look procedure includes the following: sampling of any peritoneal fluid (or washings if fluid is lacking), biopsy of both gutters, observation of the diaphragm and periaortic and pelvic wall nodes, and careful exploration of the abdomen. Often, more than 10 biopsies are taken in such patients. The majority of patients in whom these examinations are negative will be long-term survivors. Piver et al, however, found that sequential therapy consisting of chemotherapy, second-look exploratory laparotomy, and whole-abdomen irradiation did not significantly improve the survival rates in women with advanced adenocarcinoma of the ovary.[41]

Patients with pelvic masses that do not change in size over a long period of observation or chemotherapy usually have adherent masses of the small bowel. Ovarian cancer will either respond to chemotherapy or progressively grow.

Exploration is contraindicated in heavily irradiated patients, patients treated with intraperitoneal isotopes, and patients with progressive tumor at other sites. The author opposes the indiscriminate use of computerized tomography, sonography, laparoscopy, and laparotomy in patients with obvious generalized progressive ovarian cancer, as little information useful to the patient is ever obtained. It remains to be seen whether second-look surgery will add any 5-year survivors to the 7% of women who now survive after presenting with ovarian cancer spread to the abdomen.[41]

Recently, Copeland et al discussed the role of third-look laparotomy after apparent response to continued chemotherapy. They suggest that sufficient preoperative information is usually available to make appropriate therapy decisions without resorting to third-look laparotomy. The risk of continued chemotherapy beyond 24 courses is emphasized. Though numbers were small, there was a 23% mortality rate due to toxicity associated with 24 or more courses of melphalan therapy. Continuation of chemotherapy for prolonged intervals should be strongly reconsidered in patients with only microscopic disease identified at second-look laparotomy, and repeated laparotomies to evaluate dormant disease seem unjustified.[16]

Ovarian Tumors in Children and Adolescents

Ovarian malignancies are very rare in children and produce less than 50 deaths per year in the United States.[47] Most of the neoplasms in children arise from germ cells, in contrast to adults, in whom 80% or more of the primary ovarian malignancies arise from epithelium. Barber notes that the ovary in the infant and child is an abdominal organ, and pelvic examination is often negative in the presence of an abdominal mass of ovarian origin.[7]

Symptoms are abdominal pain, pressure, and those symptoms associated with the phenomena of torsion, hemorrhage, or hormone production. Torsion is common owing to the smooth surface and long pedicles, and acute appendicitis is the most common misdiagnosis.[36] Preoperative evaluation includes chest x-ray study, intravenous pyelogram, serum studies for gonadotropins, α-fetoprotein, and carcinoembryonic antigens, and ultrasound studies. The intravenous pyelogram is a vital study; 40% of abdominal masses in the newborn are of renal origin. The lucency of the area occupied by any large cyst is a useful diagnostic finding,[13] as is the calcification noted in 60% of cystic teratomas.[36]

Treatment involves excision of the involved ovary or internal genitalia, depending on the nature of the lesion. This is best done where competence in the complex pathology of these rare neoplasms is available. Excise the cyst and await frozen section diagnosis. If the tumor is solid, excise the ovary and obtain a frozen section diagnosis. If the pathologist cannot arrive at a diagnosis at the time of frozen section, close the abdomen. After the correct diagnosis is obtained, additional surgery may be indicated. If removal of the remaining uterus and ovary is being considered, it is helpful to remember that most ovarian tumors in childhood are unilateral and benign.

Multiple retention, giant follicular, theca and corpus luteum cysts account for almost all ovarian masses in newborns and are uniformly benign.[5] The most common ovarian neoplasms in infants and children are cystic teratomas and their malignant counterparts.[7] The most frequent tumors in adolescents, in order of decreasing frequency, are cystic teratoma, mucinous cystadenoma, serous cystadenoma, corpus luteum cysts, paraovarian cysts, and endometriomas. Less common tumors are embryonal teratomas, granulosa cell tumors, dysgerminoma, endodermal sinus tumor, and carcinoma.[7]

Ovarian Tumors in Pregnancy

Physiologic enlargement of the ovary to form a corpus luteum of pregnancy is a normal event. This cystic mass rarely exceeds 6 cm in size and subsides as the placenta assumes endocrine support of the pregnancy. Ultrasound is used to document the decrease in size of this normal cystic mass. When an adnexal mass persists into the second trimester of pregnancy, exploration is indicated. Immediate exploration is necessary if the patient develops ascites, if the mass is bilateral, nodular, or solid, or if torsion or hemorrhage occur. About 1 in 1,000 pregnancies require exploration.[55] Less than 5% of the patients requiring exploration have a malignant lesion.[38] Hill et al reported 57 ovarian masses found at exploration or seen on referral; there were 38 benign cysts such as cystic corpus luteum, 7 mature cystic teratomas, 4 endometriomas, and 5 benign and 3 malignant epithelial cystadenomas[30] (Fig. 21-15).

Novak et al reported 100 cases of ovarian tumors associated with pregnancy.[39] These cases were reference cases sent to the Emil Novak Tumor Registry over a 30-year period and are therefore the unusual and uncommon lesions, with high incidence of malignant tumors; 15 benign corpus luteum lesions were eliminated from the report. The 5-year survival rates were as follows: 75% in 45 epithelial lesions of the ovary; 76% in 33 germ cell tumors, among which dysgerminoma and dermoid were most common; and 85% in 14 gonadostromal tumors. Eight lesions included sarcomas and metastases.

In view of the coexistent pregnancy, the patient and her husband must have a clear understanding of the options available if malignant tumor, although rare, is found. Hill et al noted little benefit in supporting the pregnancy postoperatively with progesterone to diminish abortion and found an incidence of 24% spontaneous abortions.[30]

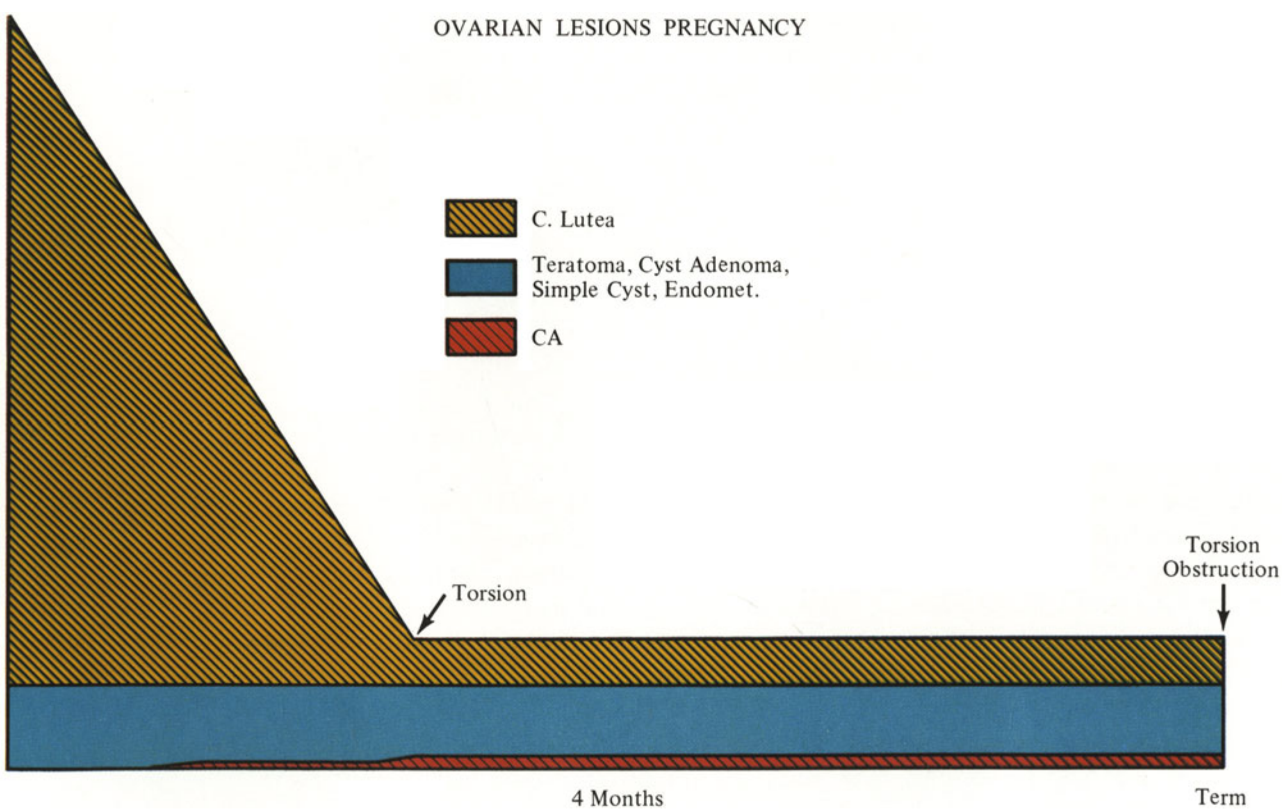


FIGURE 21-15. Ovarian masses in pregnancy. Note that the vast majority are corpus lutea and resolve under observation. Torsion occurs more commonly at 3 months and at term and the tumor may obstruct labor as well. Only 5% of persistent ovarian masses in pregnancy are malignant, in accord with the uncommon occurrence of epithelial malignancy in women under 40 years of age.

Treatment for malignant lesions does not differ from that in the nonpregnant state, but of course the use of irradiation or chemotherapy, should the patient elect to continue the pregnancy in the face of a malignant lesion of the ovary, must be avoided.

Postoperative Management and Results

Care of the postoperative ovarian surgery patient is the same as that recommended after abdominal surgery (Chapter 15). When a malignant lesion is diagnosed by the pathologist and the surgeon does not wish to administer chemotherapy, prompt consultation regarding the initiation of chemotherapy is recommended. Likewise, when irradiation therapy is the appropriate treatment, promptly consult the radiation therapist. The intraperitoneal isotopes must be placed prior to the formation of intra-abdominal adhesions.

If the ovaries are removed, consider estrogen replacement. The author recommends combination hormone therapy to minimize breast difficulties; estrogen on days 1 to 25 of the menstrual cycle and a progestational agent on days 20 to 25 of the menstrual cycle. In contrast to endometrial cancer, malignant tumors of the ovary are not a contraindication to estrogen therapy.

The prognosis and posttreatment results for various ovarian lesions have been indicated throughout the chapter. In summary, surgery for the benign ovarian lesion is clinically successful. Pelvic inflammatory disease usually responds to conservative treatment, but ruptured tuboovarian abscess demands immediate surgical intervention.

Surgery remains the cornerstone of therapy in ovarian malignancies, but both chemotherapy and irradiation therapy are useful adjuncts. The 5-year survival rates for ovarian epithelial malignancy collected from various series approximate 60% to 90% in stage I, 39% to 65% in stage II, 4% to 9% in stage III, and 0% in stage IV.[8,41,46] As most patients present with stage III ovarian cancer, aggressive investigation of ovarian masses and prompt therapy of the lesion detected are vital.

References

1. Ala Alfredi M, Vongtama V, Tsukada Y, et al: Dysgerminoma of the ovary: Radiation therapy for recurrence and metastases. *Am J Obstet Gynecol* 1976; 126:190–194.
2. Alday ES, Goldsmith HS: Surgical technique for omental lengthening based on arterial anatomy. *Surg Gynecol Obstet* 1972; 135:103–107.
3. Alexander P, Hall JG: The role of immunoblasts in host resistance and immunotherapy of primary sarcoma. *Adv Cancer Res* 1970; 13:1–37.
4. Asadourian LA, Taylor HB: Dysgerminoma: An analysis of 105 cases. *Obstet Gynecol* 1969; 33:370–379.
5. Astedt B: Ovarian neoplasms in newborns. *Nord Med* 1967; 19:87–88.
6. Babaknia A, Calfopoulos P, Jones HW: The Stein-Leventhal syndrome and coincidental ovarian tumors. *Obstet Gynecol* 1976; 47:223–224.
7. Barber HR: Managing ovarian tumors of childhood and adolescence. *Female Patient* 1978; 3:83–85.
8. Barber HR, Kwon TH: Current status of the treatment of gynecologic cancer by site. *Cancer* 1976; 38:(Suppl.)610–619.
9. Barber HR, Kwon TH, Buterman I, et al: Current concepts in the management of ovarian cancer. *J Reprod Med* 1978; 20:41–49.
10. Bast RC Jr, Klug TL, St John E, et al: A radioimmunoassay using a monoclonal antibody to monitor the course of epithelial ovarian cancer. *N Engl J Med* 1983; 309:883–887.

11. Blum M, Meidan A: Late results of conservative operation for bilateral benign ovarian tumors. *Int Surg* 1976; 61:561–562.
12. Bush RS, Allt WE, Beale FA, et al: Treatment of epithelial carcinoma of the ovary: Operation, irradiation, and chemotherapy. *Am J Obstet Gynecol* 1977; 127:692–704.
13. Carlson DH, Grimscom NT: Ovarian cysts in the newborn. *Am J Roentgenol Radium Ther Nucl Med* 1972; 116:664–672.
14. Carter RP: Early diagnosis of ovarian cancer, in Masterson BJ (ed): *Proceedings of Symposium on New Developments in Gynecologic Cancer.* Lawrence, KS, University of Kansas Printing Service, 1978.
15. Christ JE, Lotze EC: The residual ovary syndrome. *Obstet Gynecol* 1975; 46:551–555.
16. Copeland LJ, Wharton JT, Rutledge FN, et al: Role of "third-look" laparotomy in the guidance of ovarian cancer treatment. *Gynecol Oncol* 1983; 15:145–153.
17. Cunningham FG, Hauth JC, Strong JD, et al: Evaluation of tetracycline or penicillin and ampicillin for the treatment of acute pelvic inflammation disease. *N Engl J Med* 1977; 296:1380–1383.
18. Daly JW, Monif GR: Tuboovarian and ovarian abscesses, in Monif GR (ed): *Infectious Diseases in Obstetrics and Gynecology.* Hagerstown, Md, Harper & Row, 1974.
19. Dembo AJ, Bush RS, Beale FA, et al: The Princess Margaret Hospital study of ovarian cancer: Stages I, II and asymptomatic III presentations. *Cancer Treat Rep* 1979; 63:249–254.
20. DiSaia PJ, Townsend DE, Morrow CP: The rationale for less than radical treatment for gynecologic malignancy in early reproductive years, *Obstet Gynecol Surv* 1974; 29:581–593.
21. Duignan NM: Polycystic ovarian disease. *Br J Obstet Gynaecol* 1976; 83:593–602.
22. Edwards CL, Herson J, Gershenson DM, et al: A prospective randomized clinical trial of melphalan and *cis*-platinum versus hexamethylmelamine, adriamycin, and cyclophosphamide in advanced ovarian cancer. *Gynecol Oncol* 1983; 15:261–277.
23. Fisher B: The changing role of surgery in the treatment of cancer, in Becker F (ed): *Cancer.* New York, Plenum, 1977.
24. Franklin EW, Hevron JE, Thompson JD: Management of the pelvic abscess. *Clin Obstet Gynecol* 1973; 16:66–79.
25. Gershenson DM, DelJunco G, Herson J, et al: Endodermal sinus tumor of the ovary: The M.D. Anderson experience. *Obstet Gyencol* 1983; 61:194–202.
26. Gynecologic cancer. Am Coll Obstet Gynecol Tech Bull no. 24:1–7, 1973.
27. Hager WD: Follow-up of patients with tubo-ovarian abscess(es) in association with salpingitis. *Obstet Gynecol* 1983; 61:680–684.
28. Hellstrom I, Hellstrom KE, Sjogren HO: Serum mediated inhibition of cellular immunity of methycholanthrene-induced murine sarcomas. *Cell Immunol* 1970; 1:18–30.
29. Hilaris BS, Clark DGC: The value of postoperative intraperitoneal injection of radiocolloids in early cancer of the ovary. *Am J Roentgenol Radium Ther Nucl Med* 1971; 112:749–754.
30. Hill LM, Johnson CE, Lee RA: Ovarian surgery in pregnancy. *Am J Obstet Gynecol* 1975; 122:565–569.
31. Hjortrup A, Kehlet H, Lockwood K, et al: Long-term clinical effects of ovarian wedge resection in polycystic ovarian syndrome. *Acta Obstet Gynecol Scand* 1983; 62:55–57.
32. Humphrey L, Panoussopoulos D, Volenec FJ, et al: The role of tumor immunity in ovarian cancer. *South Med J* 1977; 70:1186–1187.
33. Lawson TL, Albaretti JN: Diagnosis of gynecologic pelvic masses by gray scale ultrasonography: Analysis of specificity and accuracy. *Am J Roentgenol* 1977; 128:1003–1006.
34. Mahesh VB, Toledo SP, Mattar E: Hormone levels following wedge resection in polycystic ovary syndrome. *Obstet Gynecol* 1978; 51:64–68.

35. Mansfield C: Role of radioisotope in ovarian cancer, in Masterson BJ (ed): *Proceedings of Symposium on New Developments in Gynecologic Cancer.* Lawrence, KS, University of Kansas Printing Service, 1978.
36. Moore JG, Schifrin BS, Erez S: Ovarian tumors in infancy, childhood, and adolescence. *Am J Obstet Gynecol* 1967; 90:913–922.
37. Moyle JW, Rochester D, Sider L, et al: Sonography of ovarian tumors: Predictability of tumor type. *AJR* 1983; 141:985–991.
38. Munnell EW: Primary ovarian cancer associated with pregnancy. *Clin Obstet Gynecol* 1963; 6:983–993.
39. Novak ER, Lambrou CD, Woodruff JD: Ovarian tumors in pregnancy. *Obstet Gynecol* 1975; 46:401–406.
40. Parker RT, Parker CH, Wilbanks GD: Cancer of the ovary. *Am J Obstet Gynecol* 1970; 108:878–888.
41. Piver MS, Barlow JJ, Lee FT, et al: Sequential therapy for advanced ovarian adenocarcinoma: Operation, chemotherapy, second-look laparotomy, and radiation therapy. *Am J Obstet Gynecol* 1975; 122:355–358.
42. Piver MS, Barlow JJ, Lele SB: Incidence of subclinical metastasis in stage I and II ovarian carcinoma. *Obstet Gynecol* 1978; 52:100–104.
43. Piver MS, Lele S, Barlow JJ: Preoperative and intraoperative evaluation in ovarian malignancy. *Obstet Gynecol* 1976; 48:312–315.
44. Ranney B, Chastain D: Ovarian function, reproduction and later operations following adnexal surgery. *Obstet Gynecol* 1978; 51:521–528.
45. Rutledge F, Boronow RC, Wharton JT: Treatment of epithelial cancer of the ovary, in *Gynecologic Oncology.* New York, Wiley, 1976.
46. Schein PS: Chemotherapy in advanced ovarian cancer. *Geriatrics* 1973; 28:89–95.
47. Silverberg E: Cancer statistics, 1977. *Ca—Cancer J Clinicians* 1977; 27:26–41.
48. Smith JP, Day TG: Review of ovarian cancer at the University of Texas Systems Cancer Center, M.D. Anderson Hospital and Tumor Institute. *Am J Obstet Gynecol* 1979; 135:984–993.
49. Stamp GWH, McConnell EM: Malignancy arising in cystic ovarian teratomas. A Report of 24 cases. *Br J Obstet Gynaecol* 1983; 90:671–675.
50. Stein I: Diagnosis and treatment of bilateral polycystic ovaries in the Stein-Leventhal syndrome. *Int J Fertil* 1958; 3:20–26.
51. Talerman A: Germ cell tumors of the ovary, in Blaustein A (ed): *Pathology of the Female Genital Tract.* New York, Springer-Verlag, 1977.
52. Uhrich PC, Sanders RC: Ultrasonic characteristics of pelvic inflammatory masses. *J Clin Ultrasound* 1976; 4:199–204.
53. Weinstein D, Polishuk WZ: The role of wedge resection of the ovary as a cause for mechanical sterility. *Surg Gynecol Obstet* 1975; 141:417–418.
54. Wharton LR: Surgery of benign adnexal disease: Endometriosis, residuals of inflammatory and granulomatous disease, and ureteral injury, in Ridley J (ed): *Gynecologic Surgery: Errors, Safeguards, Salvage.* Baltimore, Williams & Wilkins, 1974.
55. White KC: Ovarian tumors in pregnancy. *Am J Obstet Gynecol* 1973; 116:544–548.
56. Whitney RB, Levy JG, Smith AG: Influence of tumor size and surgical resection on cell-mediated immunity in mice. *J Natl Cancer Inst* 1974; 53:11–116.
57. Williams TJ, Dockerty MB: Status of the contralateral ovary in encapsulated low grade malignant tumors of the ovary. *Surg Gynecol Obstet* 1976; 143:763–766.

Selected Bibliography

Barber HRK: *Ovarian Carcinoma: Etiology, Diagnosis and Treatment,* 2nd ed. New York, Masson, 1982.

Blaustein A (ed): *Pathology of the Female Genital Tract,* 2nd ed. New York, Springer-Verlag, 1982.

DiSaia P, Morrow P, Townsend D: *Synopsis of Gynecologic Oncology.* New York, Wiley, 1975.

Norris HJM, Chorlton I: Functioning tumors of the ovary. *Clin Obstet Gynecol* 1974; 17:189–228.

Novak ER, Jones GS, Jones HW: *Novak's Textbook of Gynaecology,* 9th ed. Baltimore, Williams & Wilkins, 1975.

Rutledge F, Boronow RC, Wharton JT: *Gynecologic Oncology,* New York, Wiley, 1976.

Scully RE: Ovarian tumors. *Am J Pathol* 1977; 87:686–720.

Management of Bowel Injuries in Gynecologic Surgery

22

This chapter deals with the operative management of the gastrointestinal tract. Lesions are discussed in two groups: first, operative injuries occurring at the operating table that require management at that time; and second, a group of procedures involving the gastrointestinal tract in association with other gynecologic conditions.

Operative Injuries

Most injuries in any surgical procedure can be traced to inadequate exposure due to poor light, unsatisfactory assistance, or poor choice of incision. Undue haste before adequate exposure is obtained is a senseless economy in surgery. There are, however, an irreducible number of operative injuries involving the gastrointestinal tract that occur in gynecologic surgery.

Small Intestine

One may injure the small bowel while opening the wound, freeing adhesions from the bowel to the anterior abdominal wall from prior surgical procedures, or mobilizing the bowel from the pelvis in endometriosis or other conditions in which the bowel might become fixed. On noting injured small bowel, wall it off from the abdominal cavity and inspect it (Fig. 22-1). If the injury is through the serosa in otherwise healthy bowel, place interrupted 4–0 sutures transversely through the seromuscular layer covering the defect. If the muscularis is injured from a simple incision that does not devitalize the bowel and the mucosa is not injured, place a single layer of 4–0 suture tranversely in the defect. If the lumen of the small bowel is entered, one must determine the viability of the bowel surrounding the injured area. Any dead bowel wall or bowel wall that has suffered severe enough injury to make its viability questionable is then resected. If there are two injuries close to each other, resect the injured bowel and perform an end-to-end anastomosis (Figs. 22-2 through 22-7).

If the injury does not involve the majority of the circumference of the small bowel, close the defect in two layers: the inner layer with interrupted 4–0 absorbable through and through the bowel wall, and the outer layer with a 4–0 suture into the submucosa, inverting the second layer (Figs. 22-8 and 22-9). Note that much experimental work has shown that one-layer

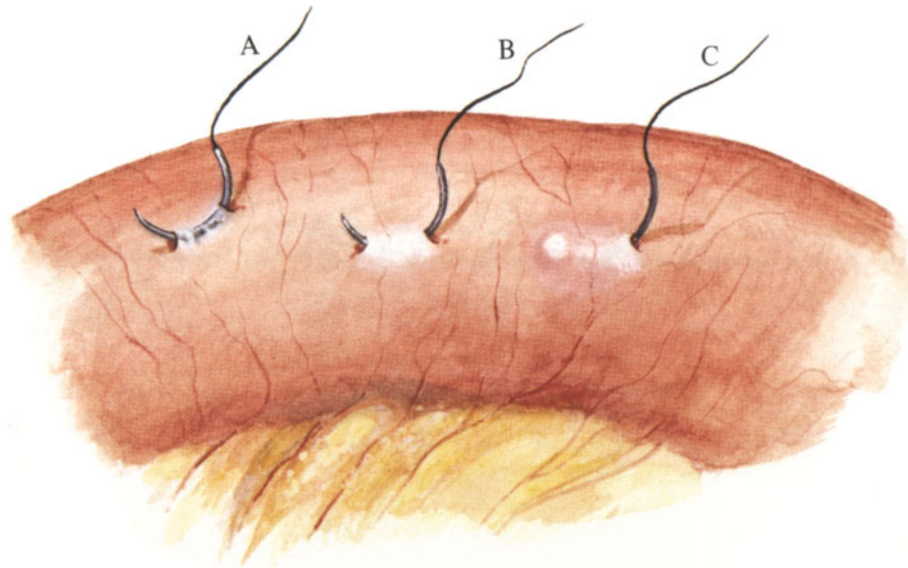


FIGURE 22-1. Three layers of bowel used in gut surgery. Needle A is simply through the serosa, needle B enters the muscularis, and needle C enters the submucosa. The placement of sutures in the submucosa is important as this is the holding layer of the bowel. A definite resistance will be felt when the needle enters this layer, and the white circle at the needle tip is characteristic, confirming that the proper layer is being used for gut surgery.

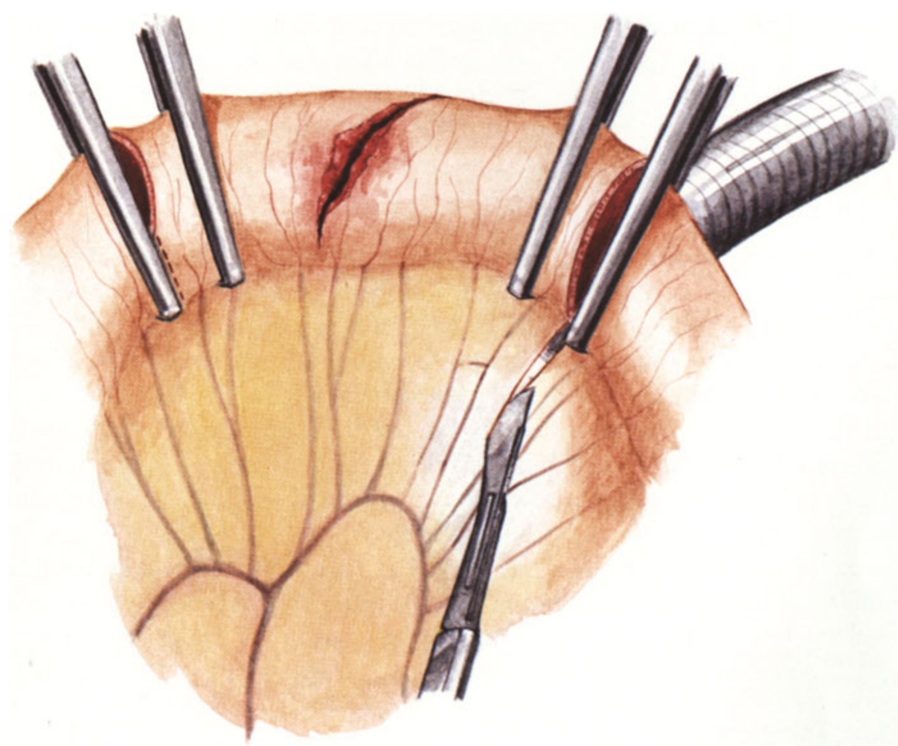


FIGURE 22-2. Repair of small-bowel injury. Isolate the bowel to be excised with Glassman nontraumatic forceps or use straight Masterson clamps, taking care not to close them fully. The fiberoptic tube light is used to transilluminate the mesentery to aid in identifying blood vessels. Ligate mesenteric vessels with 3–0 suture ligatures or ties.

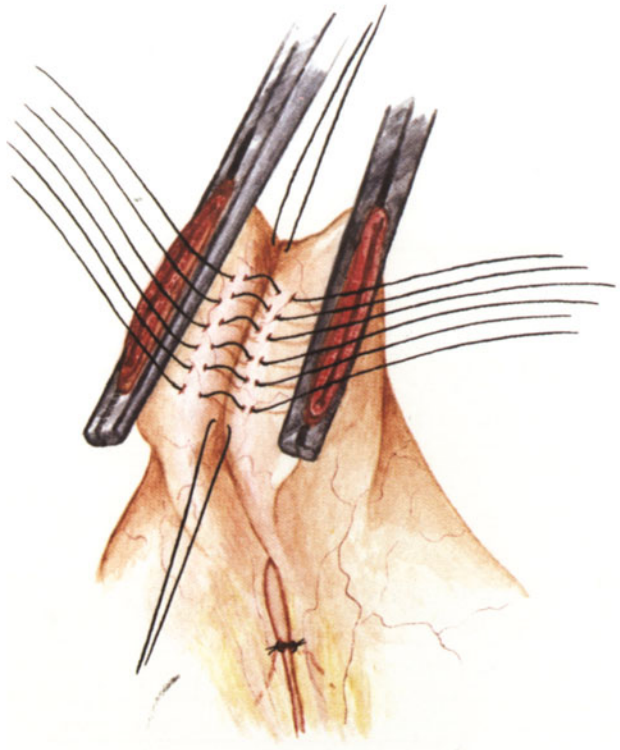


FIGURE 22-3. Trim the mesentery back from the edge of the small bowel and bring the bowel clamps together as indicated. Place lateral stay sutures of 4–0 and attach a hemostat to each. Place an outer layer of 4–0 interrupted sutures as shown. In end-to-end anastomosis, the posterior seromuscular layer is placed close enough to the lumen to avoid marked inversion, which produces a partial obstruction in some anastomoses.

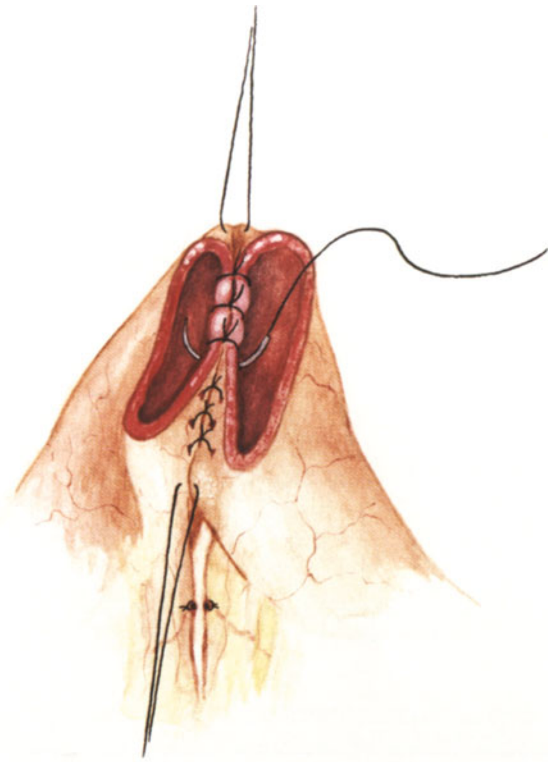


FIGURE 22-4. Remove the Glassman clamps. Trim any devitalized tissue and secure hemostasis. Close the inner layer with interrupted 4–0 absorbable suture with the knots inside the lumen. A continuous inner layer is acceptable in unirradiated bowel. Place intestinal Allis clamps on the unsutured bowel margin to evert the edges.

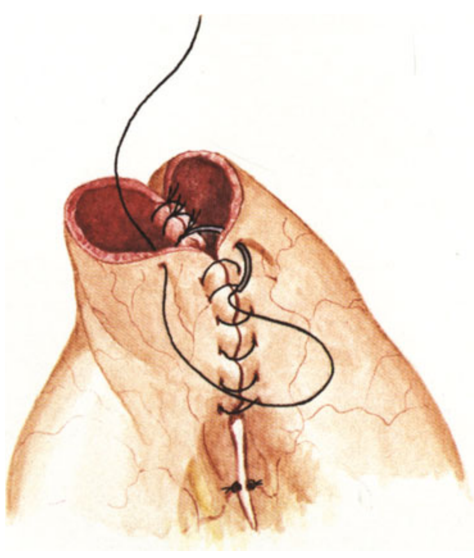


FIGURE 22-5. Continue the through-and-through inner layer around to close the circumference of the bowel. Traction on the stay suture will help invert the mucosa into the lumen. Look into the lumen to make certain that no suture has penetrated the gut and attached the opposite side, thereby obstructing the lumen.

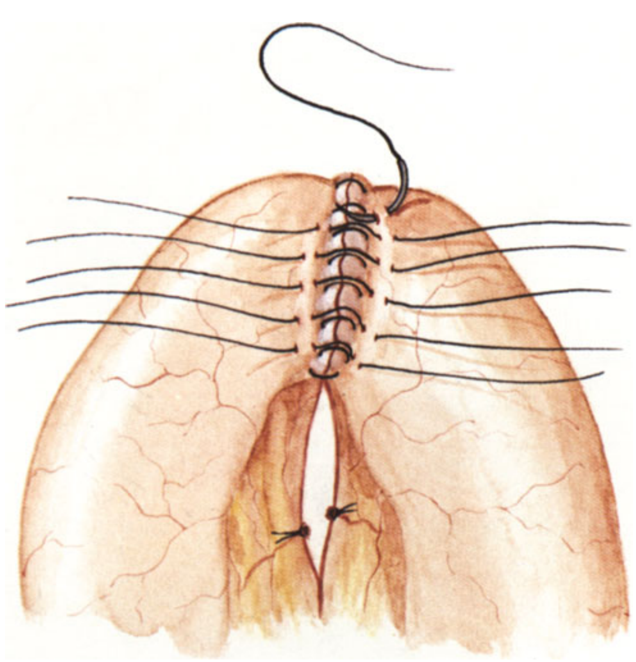


FIGURE 22-6. Place an outer layer of 4–0 suture covering the inner layer. Make certain the mesenteric border is well closed. Remove the stay suture. Palpate the lumen between the thumb and index finger and squeeze bowel contents through, further checking the security of the anastomosis.

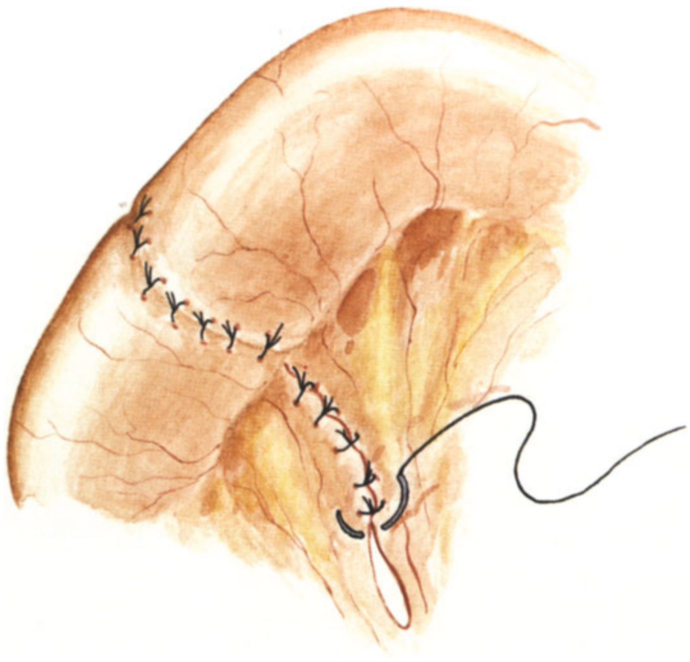


FIGURE 22-7. Close the defect in the mesentery. Avoid mesenteric vessels by transilluminating the mesentery.

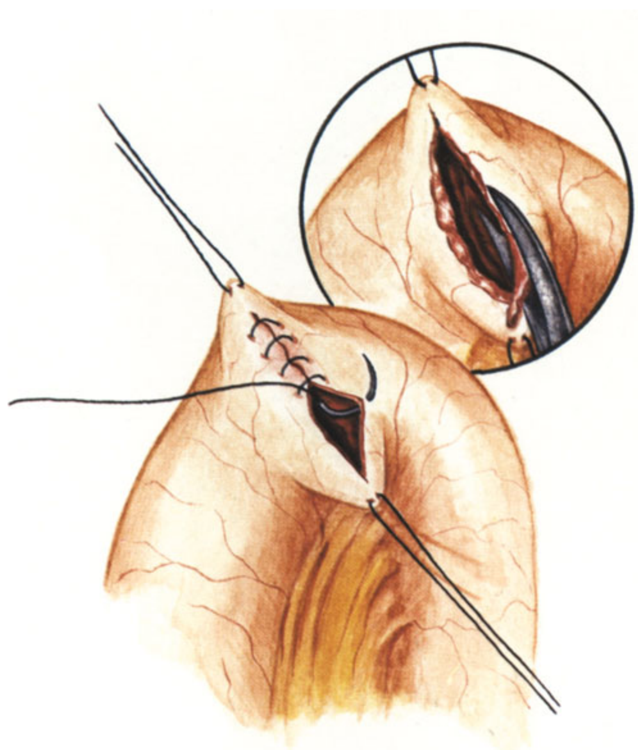


FIGURE 22-8. Two-layer repair of bowel injury. Place two stay sutures of 4–0. Trim any devitalized bowel wall and convert the defect to a transverse wound. Close the inner layer with 4–0 absorbable suture.

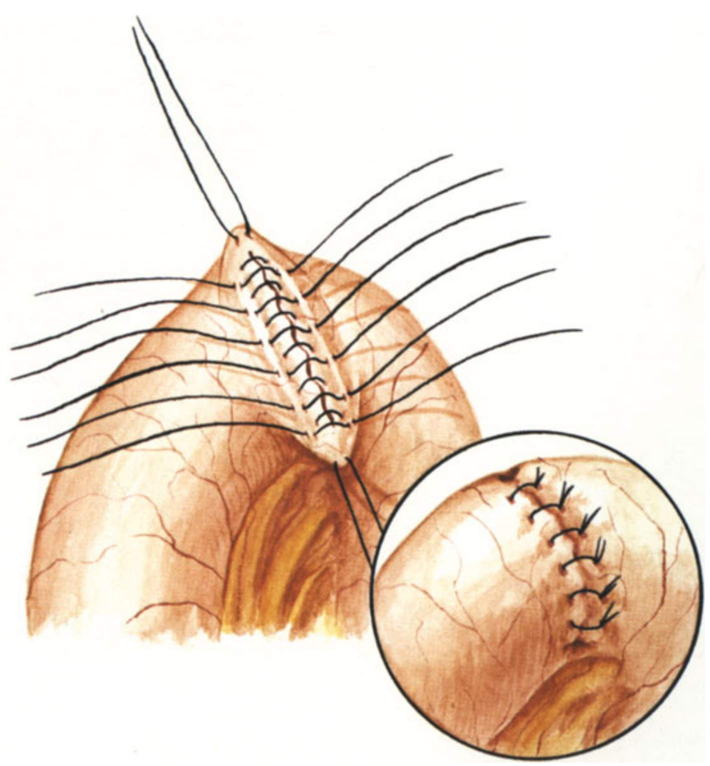


FIGURE 22-9. Place an outer layer of seromuscular suture and tie snugly but not so as to obstruct the blood supply. Remove the stay sutures.

small-bowel anastomosis is quite adequate and results in a larger lumen;[12] however, two-layer anastomosis is the most common anastomosis done and probably is safer for the surgeon occasionally operating on bowel, providing there is not too much bowel wall inversion.

After the anastomosis is complete, check the mesentery for any bleeding points and close any remaining mesenteric defect. Remove the laparotomy tapes walling off the area of repair and irrigate the abdominal cavity with warm saline. The intended procedure is then continued. Remember to inspect the bowel at the end of the procedure for continued viability.

Check the anastomosis both by palpating the lumen and by compressing bowel contents between the fingers and forcing it through the repaired lumen. The majority of anastomoses leak to some extent; therefore, the anastomosis must be in the peritoneal cavity, which has a reliable defense mechanism to prevent infection, necrosis, and ultimate dehiscence.[10] If the bowel injury is associated with a procedure for endometriosis or pelvic inflammatory disease in which a large amount of the peritoneum might be removed or with exenterative procedures in which the anastomosis would lie in an unperitonealized area, it will be at significant risk. The development of an omental pedicle to surround the anastomosis is worthwhile. Anastomoses should never lie in contact with drains or other foreign objects as this increases the failure rate.

At the time of bowel injury, begin the patient on intravenous antibiotics. These may be discontinued after 24 hours, and with small-bowel injury the likelihood of abdominal infection is slight. Occasionally, a loop of small bowel may be trapped behind a retractor and not noticed until the end of the procedure. If it is still viable, the bowel should quickly resume an appearance similar to adjoining loops of bowel and the mesenteric vessels should be seen pulsating in the area immediately adjacent to the small bowel. Furthermore, elicit peristalsis by gently stimulating the injured segment of bowel. Place a warm pack over the segment in question for a few minutes. If dark blue color persists, the serosa is dull, peristalsis is absent, and the mesenteric vessels do not pulsate, the segment in question is resected, with the resection carried to an area of good blood supply. Bear in mind that successful reconstructive procedures require an unquestioned blood supply and a tension-free anastomosis.

Gastrointestinal and Other Vessels

Occasional injuries from misplaced retractors, forceful exploration, mobilization of large tumor masses, or misdiagnosis may require the gynecologist to make an immediate decision regarding vascular injuries. Gastric vessels can be ligated with impunity, as can the splenic artery and vein, the inferior mesenteric artery and vein, and the internal iliac artery and vein. Bleeding from the vena cava below the renal vein can usually be controlled with finger pressure and repaired with a running 5–0 arterial silk. The external iliac vein and the common iliac can be ligated if repair is impossible, although leg swelling may occur.

Acute loss of the superior mesenteric artery will rarely permit continued viability of the small bowel and is a life-threatening event requiring immediate consultation, careful planning, and attempted repair or grafting.[6]

Colon

In any patient in whom the possibility of entering the lower gastrointestinal tract during the course of the procedure is anticipated, meticulous preoperative preparation is essential. The patient should be advised of the possibility of a colostomy, fistula formation, or wound infection with prolonged hospitalization. Careful mechanical cleansing of the bowel is absolutely essential as it allows the surgeon to perform any necessary procedure to the colon at the time of the initial surgery and reduces the incidence of infection if the bowel is entered (Table 22-1, Figs. 22-10 through 22-12). On the author's service, any patient operated on for ovarian cancer or any fixed pelvic mass goes through this protocol for bowel cleansing.

The importance of prophylactic oral antimicrobial agents in the preoperative preparation of a patient whose gastrointestinal tract may be injured has been clearly documented by Clarke et al[4] and Goldring et al.[7] In Goldring's clinical study of 50 patients undergoing elective colon surgery, 25 were given 1 g oral kanamycin and 200 mg metronidazole every six hours for three days. Of these patients, only two developed wound infections, whereas 11 control patients developed postoperative infections.

Irvin et al studied blood volume in patients with mechanical bowel preparation and found little evidence that fluid or electrolyte imbalance resulted.[9] Hypotension on induction of anesthesia is common, however, and these symptoms respond to saline or lactated Ringer's saline.

Should the surgeon accidently enter the right colon, the bacterial flora there are not significantly different from those in the small bowel, and even in unprepared bowel, infection is much less likely than in the left colon. (See Chapter 5 for a detailed discussion of the bacterial physiology of the intestinal tract.) After it has been determined that there is no nonviable gut, two-layer closure of the injury with 3–0 or 4–0 suture should produce satisfactory results. The use of cecostomy as a defunctioning procedure is unnecessary. After the bowel wound has been closed, copiously irrigate the area around the wound. Intravenous antibiotics should be started promptly at the time of injury and continued for 24 hours.

The transverse colon is rarely injured in gynecologic procedures and both hepatic and splenic flexures are well out of the operative site. The rectum and sigmoid colon, however, are intimately involved with many gynecologic tumors, pelvic masses, abscesses, and fistulas.

Serosal injury of the colon without injury to the mucosa may be oversewn with interrupted 3–0 or 4–0 suture. If the unirradiated colon is perforated and the bowel has had adequate preoperative preparation with antibiotics and mechanical cleansing, simple closure in two layers will be satisfactory, particularly if the wound is clean and there has been minimal soiling of the pelvis. If in unprepared bowel the colon has been perforated or clamped with large crushing clamps that devitalized a segment of sigmoid with significant fecal contamination, resection of the devitalized tissues, two-layer closure, and proximal colostomy are necessary. The procedure of closing the injured

TABLE 22-1. 72-Hour Bowel Preparation

1. Liquid diet
2. Vitamin K, tablet, 5 mg b.i.d., by mouth (p.o.)
3. Magnesium citrate, 10 oz 48 hours prior to surgery
4. Saline enema until clear 24 hours prior to surgery
5. Patient to evacuate rectum 6:30 AM on day of surgery
6. 48 hours prior to surgery: 1 g kanamycin p.o. every hour for 4 hours then every 6 hours until surgery and 250 mg p.o. metronidazole t.i.d.; or 1 g neomycin p.o. and 1 g erythromycin p.o. at 1 PM, 2 PM, and 11 PM on day prior to surgery

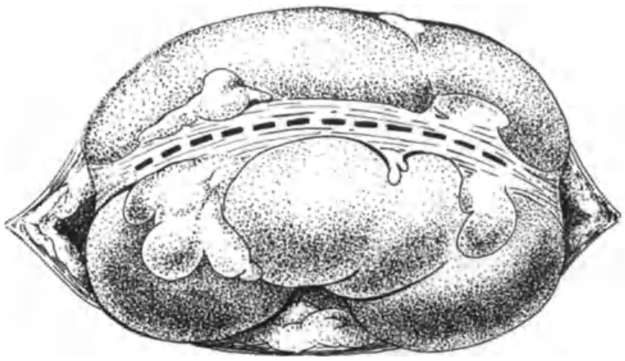


FIGURE 22-10. Transverse colostomy as described by Chassin[3] is suitable for emergency fecal diversion in colon injury, compromised repair of colon, or for the relief of an obstruction of the left colon. Remember that it may not be adequate for impending rupture of the cecum in left colon obstruction. Decompress the cecum as well in that instance. Make a short transverse upper abdominal incision above the laparotomy wound 6 cm in length. If the colon is distended, decompress with a needle inserted through the tenia at the site of later incision. Dissect the greater omentum off the colon and mobilize the transverse colon into the wound. Create a defect allowing the colon to protrude through and replace the omentum below the colon. Ligate any bleeding omental vessels with 4–0 ties. Close the fascial incision if too large with far-and-near sutures of 0-gauge Polydiazonone (PDS) or Prolene, but do not compromise the lumen or the blood supply of the colon. No sutures are needed between the colon and the abdominal wall.

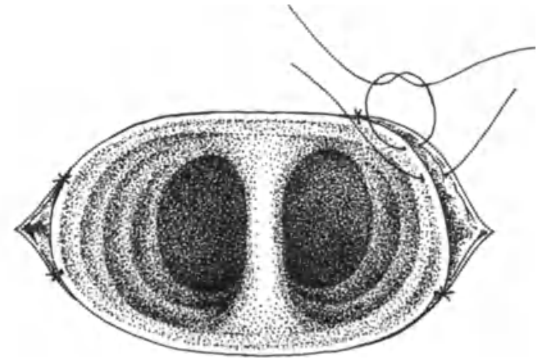
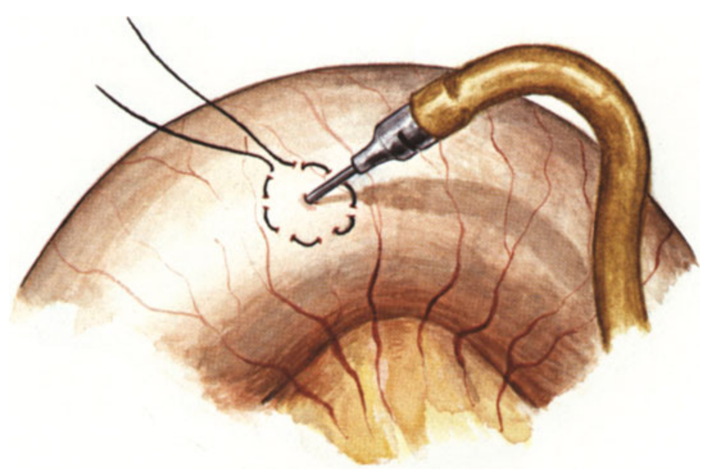


FIGURE 22-11. Make a 6-cm incision in the tenia. Suture the full thickness of the colon wall to the subcuticular layer of the skin with 4–0 absorbable. Try to produce a smooth mucocutaneous junction. Avoid crushing clamps in the skin or colon wall. Although mucosal prolapse may occur with this technique, immediate maturation prevents the large unsightly edematous stoma in which persistent serositis precludes early closure. This colostomy is completely diverting. Irrigate the wound if contaminated by stool with kanamycin or povidone-iodine solution. Pericolostomy infection is, however, surprisingly uncommon. Do not use a bovie for hemostasis in the subcutaneous skin to minimize wound infection.

FIGURE 22-12. Decompression of bowel. Place a purse-string suture in the segment of bowel to be decompressed. Isolate the area with laparotomy tapes. Use an 18-gauge needle and attach to wall suction. Insert the needle into the gut and aspirate. Be careful not to lacerate the opposite side of the bowel wall. Remove the needle and tubing and pull the purse-string sutures together. Discard any contaminated drapes.



segment and exteriorizing it to observe adequate healing, although attractive from a technical point of view, is of little benefit in gynecology because most of the injuries occur so low in the colon that it cannot be mobilized out of the pelvis. If the colon has previously been irradiated, there should be no haste in closing the colostomy, protecting the repair. The surgeon should allow at least 6 to 8 weeks for the colon to heal and then perform a barium study of the distal colon before the colostomy is closed.

Surgery for Obstruction

The gynecologist rarely operates on patients with bowel obstruction except when managing a gynecologic oncology service. Occasionally, however, the gynecologist may encounter a patient who has a misdiagnosed intestinal injury or early intestinal obstruction and needs to have some basic information on their management.

Non-neoplastic Small Bowel Obstruction

In patients with bowel obstruction, attention to preoperative details is particularly significant. Fluid and electrolyte balances should be brought within the normal range promptly. The loss of sodium chloride with 3,000 to 4,000 mL fluid into the obstructed gut is well documented. Gastrointestinal losses with high small-bowel obstruction include excessive loss of chloride and potassium and resultant hypochloremic and hypokalemic alkalosis. Replacement with a sodium chloride solution with supplemental potassium is indicated. Remember that patients with high small-bowel obstruction may have minimal air fluid levels on flat and upright abdominal x-ray examination.[5]

The patient with simple bowel obstruction not responding to conservative measures generally has obstruction of the distal ileum; usually it is an adhesive band or hernia, or the bowel may have been sutured into the vaginal cuff after vaginal hysterectomy or other surgical error. If exposure is difficult to obtain owing to distended bowel, enter the bowel with an 18-gauge needle attached to wall suction through a small purse-string suture. The contents, which consist of significant amounts of bowel gas and liquid, may be decompressed with subsequent exposure (Fig. 22-12). The bowel is carefully run, beginning at the duodenum and progressing distally to the cecum. Most bowel obstructions that the gynecologist will see will be in the distal ileum. The bowel is freed and its viability is checked. Bowel contents may be pushed through the area that has been obstructed to make certain that there is no inherent obstruction in the bowel and to ascertain its viability. The serosa should glisten and the color of the bowel approximate the other small bowel; peristalsis should be present and the mesenteric vessels should be clearly pulsatile. If these conditions are met and bowel contents can be easily passed through the area of defect, nothing further need be done; however, if the obstruction has progressed to the point where the bowel has lost viability, then resection back to an area of healthy small bowel is necessary. Patients who have dead bowel would not normally be seen on the gynecology service, and in this case, as in all surgical procedures, consultation, if available, may be helpful. Remember that patients with nonstrangulating bowel obstruction have neither elevated WBC counts nor abdominal tenderness. Intervene early before nonviable bowel occurs, as operative mortality rises dramatically when dead bowel is present.

Gastrointestinal Complications of Carcinoma of the Ovary

The gynecologist may frequently encounter gastrointestinal injuries and involvement of the bowel as a result of carcinoma of the ovary. Laparotomy of patients with carcinoma of the ovary may show the residual disease only in the distal ileum. Such patients require resection of this tumor and end-to-end anastomosis. The distal ileum may also be involved in a large pelvic mass that is resectable; in this case resection with end-to-end anastomosis may be advisable if other tumor volume is minimal. In a series of 614 cases of cancer of the ovary seen on the Gynecological Service of Memorial-James Ewing Hospital from 1947 to 1960, 8 of 94 patients (8.5%) who underwent resection of the distal ileum and right colon for invasive, advanced, and recurrent cancer of the ovary were alive after 5 years.[1] In these cases, the lesion appeared to be isolated. Forty-two patients had small-bowel resection with disseminated disease, and there were no 5-year survivors.

More commonly, the gynecologist may be involved with patients with ovarian cancer who have small-bowel obstruction and nonresectable cancer. Burns et al,[2] Graham and Villalba,[8] and Wheeless[13] clearly showed that the procedure of choice in such patients is small-bowel bypass. Irradiation injury is likewise best managed in this fashion. The mortality rate is greatly reduced and the surgical procedure is much less complex. Bypass may be performed in one of two ways: Either an ileotransverse colostomy on a side-to-side basis (Figs. 22-13 through 22-19) or an end-to-side ileotransverse colostomy with mucus fistula brought out to the distal end of the wound (Fig. 22-20). Remember that the ileum selected must be free of tumor, have an unquestionable blood supply, and reach the colon free of any tension. The omentum with good blood supply may be brought to surround this anastomosis if any remains.

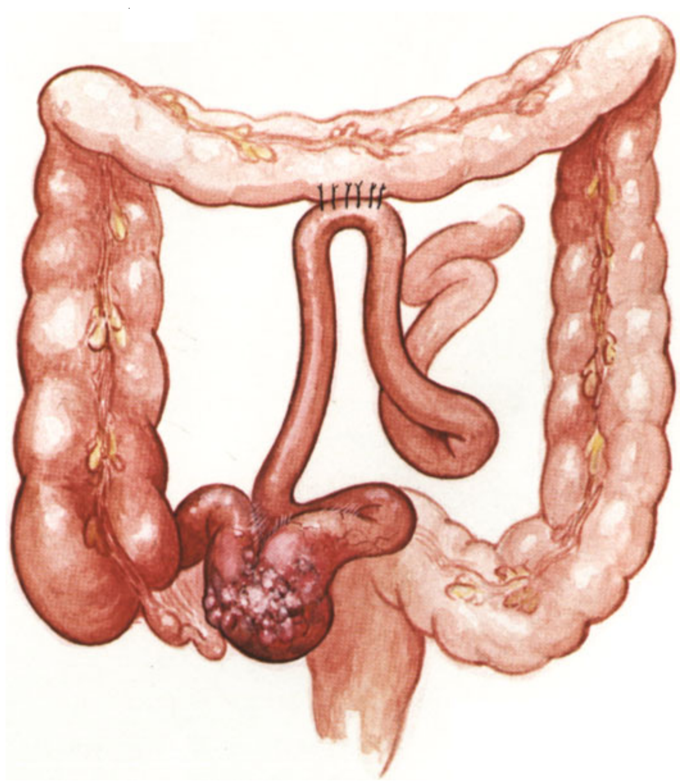


FIGURE 22-13. Side-to-side anastomosis approximating ilium and transverse colon. The anastomosis is without tension and may be buttressed with any remaining omentum.

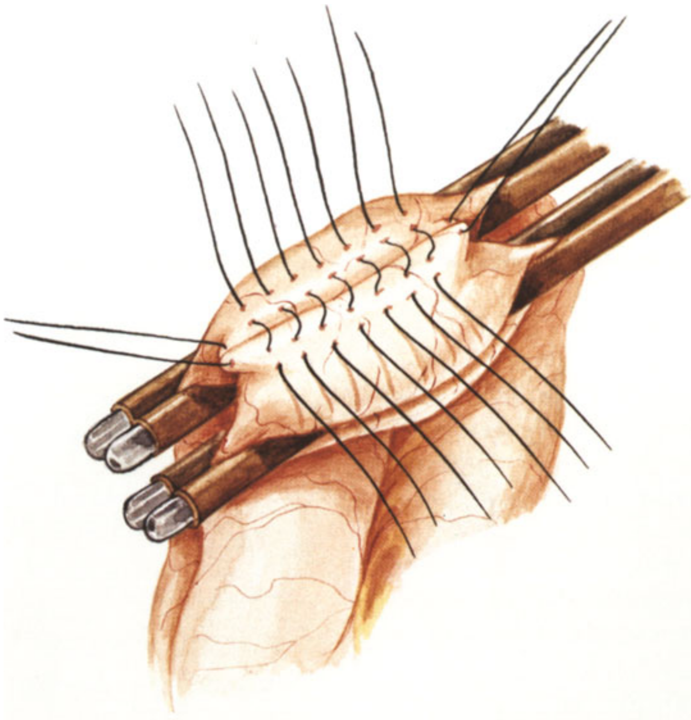


FIGURE 22-14. Select the bowel to be joined. Avoid tension or tumor at the anastomotic site. Place rubber or linen shod clamps to minimize spillage. Place a 4–0 stay suture at each end of the bowel and an outer layer of 4–0 suture joining the gut.

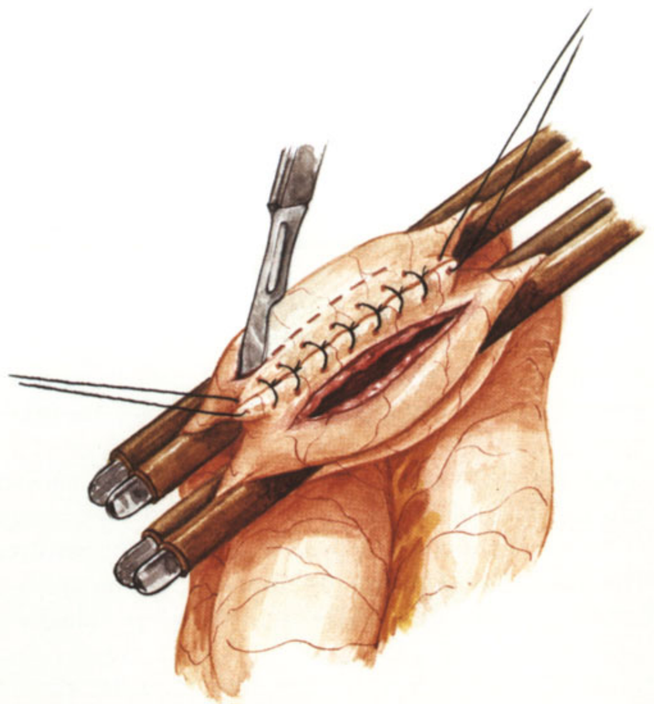


FIGURE 22-15. Incise sharply 8 to 10 cm from the suture line. Wall off the area with a laparotomy tape before opening the bowel. Secure hemostasis of the bowel edge.

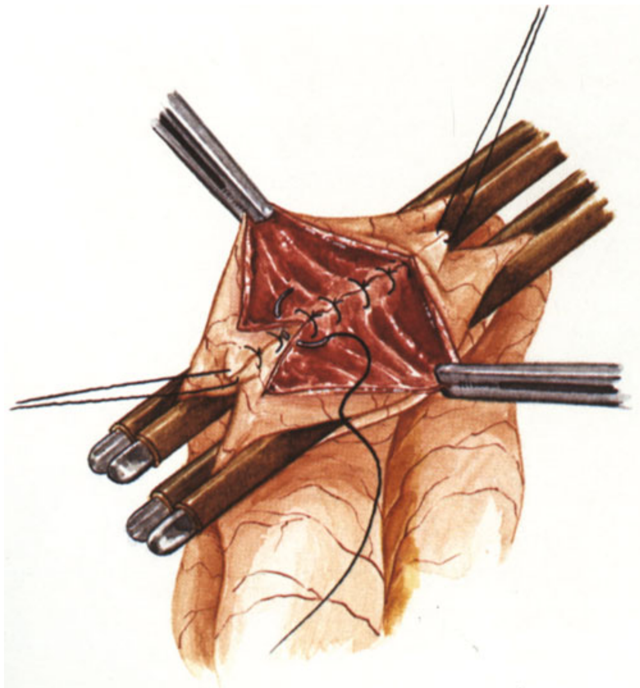


FIGURE 22-16. Place an inner layer of interrupted through-and-through 3–0 absorbable suture.

FIGURE 22-17. Continue the inner layer of 3–0 absorbable suture. Use the stay suture for tension. Invert all mucosa into the lumen.

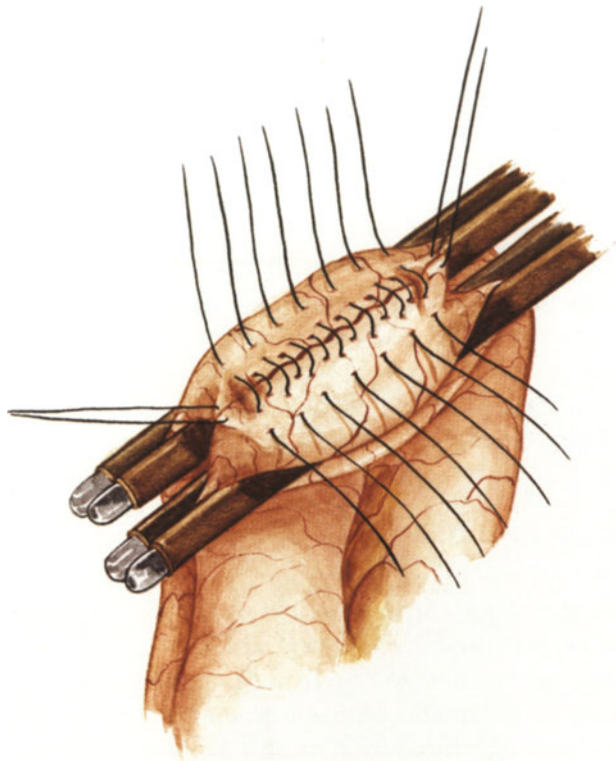


FIGURE 22-18. Place an outer layer of suture covering the inner layer. As the lumen is larger in side-to-side anastomosis, use broad seromuscular bites approximating a good cuff of serosa.

FIGURE 22-19. The stay sutures are now removed. Check the lumen between the thumb and index finger: it should be sizable. If an ileocolostomy is being performed, suture omentum about the anastomosis.

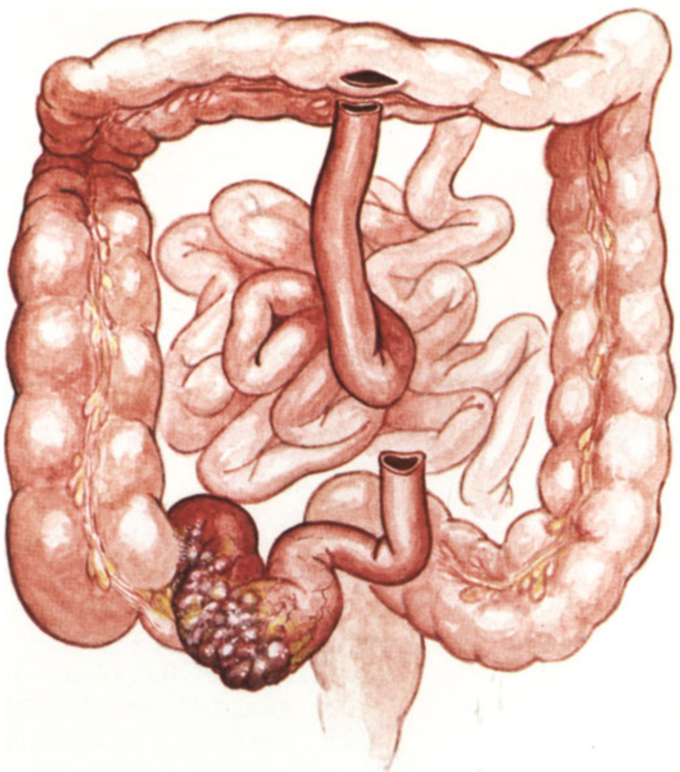


FIGURE 22-20. End-to-side anastomosis requires construction of a mucus fistula. The fistula is placed through the lower end of the midline incision and it too should be without tension. The end-to-side anastomosis is surrounded with any remaining omentum and completed with a two-layer technique similar to that outlined in side-to-side anastomosis.

Although the 5-year survivors are few in number, good palliation often results, with an excellent quality of life.

The patient who develops colon obstruction from ovarian cancer is usually obstructed in the distal rectosigmoid and is best managed with a sigmoid colostomy and mucus fistula. When the defect is created in the anterior abdominal wall, take care to avoid injury to the anastomosis between the superior and inferior epigastric vessels. The construction of the stoma is illustrated in Figs. 22-21 through 22-23. Careful selection of the colostomy site is important and is determined in part by the patient's abdominal panniculus. A preoperative visit by a stomal therapist for site selection is most helpful if colostomy is anticipated. Remember that a mucus fistula is the only exception to the dogma that one never brings a stoma through the abdominal wound. A few minutes spent carefully fashioning a stoma will avoid hours of postoperative care.

Occasionally the transverse colon becomes obstructed by ovarian cancer. The situation usually occurs when the omentum is not resected at the time of the original diagnosis and the carcinoma has produced a large cake of tumor surrounding the transverse colon. It is best to excise the transverse colon and do an anastomosis or perform a colostomy. The right colon may become obstructed and is most easily managed by ileotransverse colostomy, either side-to-side or end-to-side with mucus fistula; the author prefers the former. Avoid ileostomy as a diverting procedure if at all possible; the stomal problems are greater and the quality of life is poorer than with colostomy.

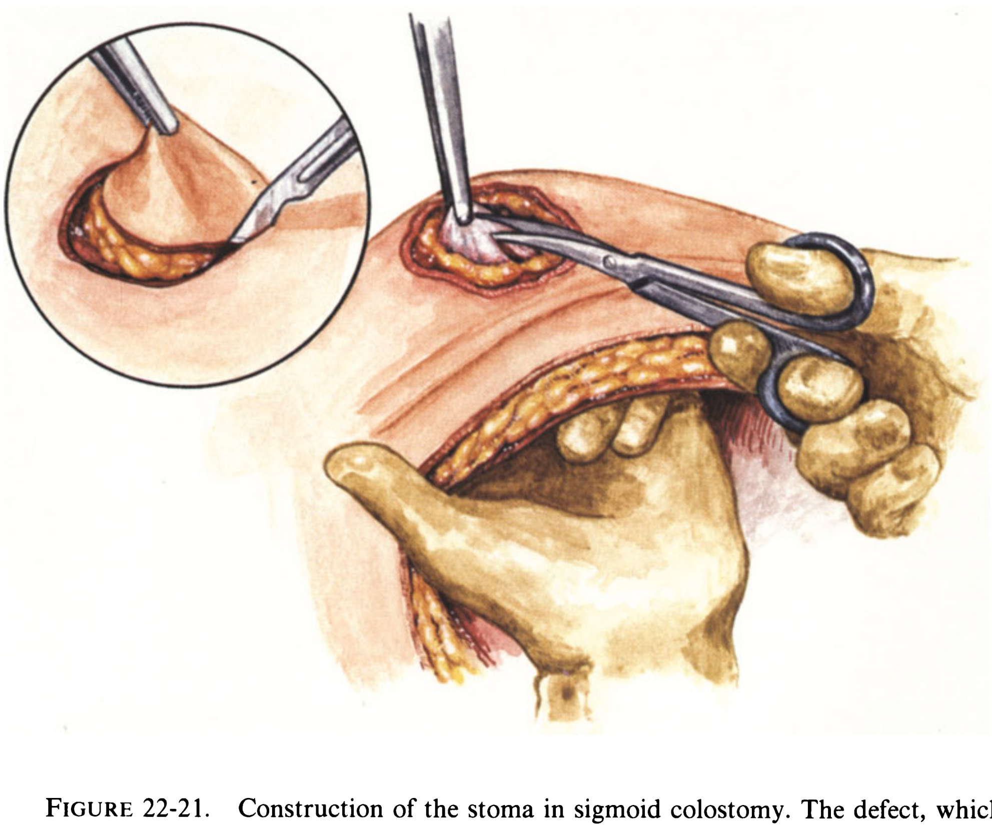


FIGURE 22-21. Construction of the stoma in sigmoid colostomy. The defect, which goes through all layers of abdominal wall, is created by excising a cylinder of tissue approximately 1.5 inches in diameter through the skin and subcutaneous tissues, including the external oblique fascia. The inferior epigastric vessels may be palpated easily from the peritoneal surface and are to be avoided with this incision. The placement of the stoma should be determined prior to surgery, although generally it is equidistant between the anterior and superior iliac spine and umbilicus.

FIGURE 22-22. The middle and index fingers pass easily through the defect created.

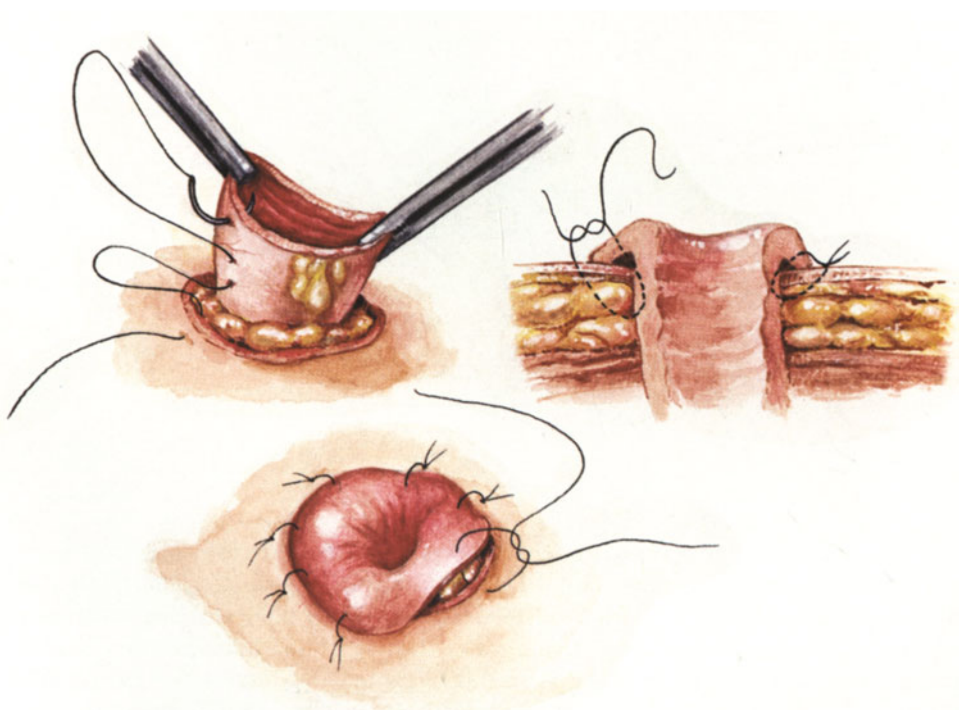


FIGURE 22-23. Whether the gut used for stoma construction is colon or small bowel, as in colostomy or ileal conduit, the skin and bowel must be joined without tension. Cut ends of the bowel should be handled with nontraumatic thumb forceps. Place a rosette stitch of 3–0 absorbable and tie it approximating mucosa to epithelium. Handle the mucocutaneous junction gently as it is important to avoid fibrosis and later stricture.

Surgery for Radiation Injury

Management of severe radiation injuries requires most careful consideration of numerous technical preoperative factors for satisfactory results. Patients with radiation injury to the colon and colic fistula may also have small-bowel fistulas as well. The bladder may be dependent on the blood supply obtained from omental adhesions or densely adherent small bowel; mobilization of the small bowel from the bladder or pelvic floor may compromise the blood supply to these organs and adjacent bowel as well. Previously, many fistulas were due to localized injuries from radium, and there was minimal damage to the remainder of the blood supply to the pelvis. Most therapeutic radiation procedures today use whole-pelvis radiation, and the vascular injury encompasses the entire pelvis. The surgeon may be surprised that after mobilization of irradiated small bowel, the patient often develops a postoperative fistula. This is caused by the peculiar nature of radiation injury and the destruction of small blood vessels in the structures irradiated.

The mortality rate from resection and anastomosis in these patients is high,

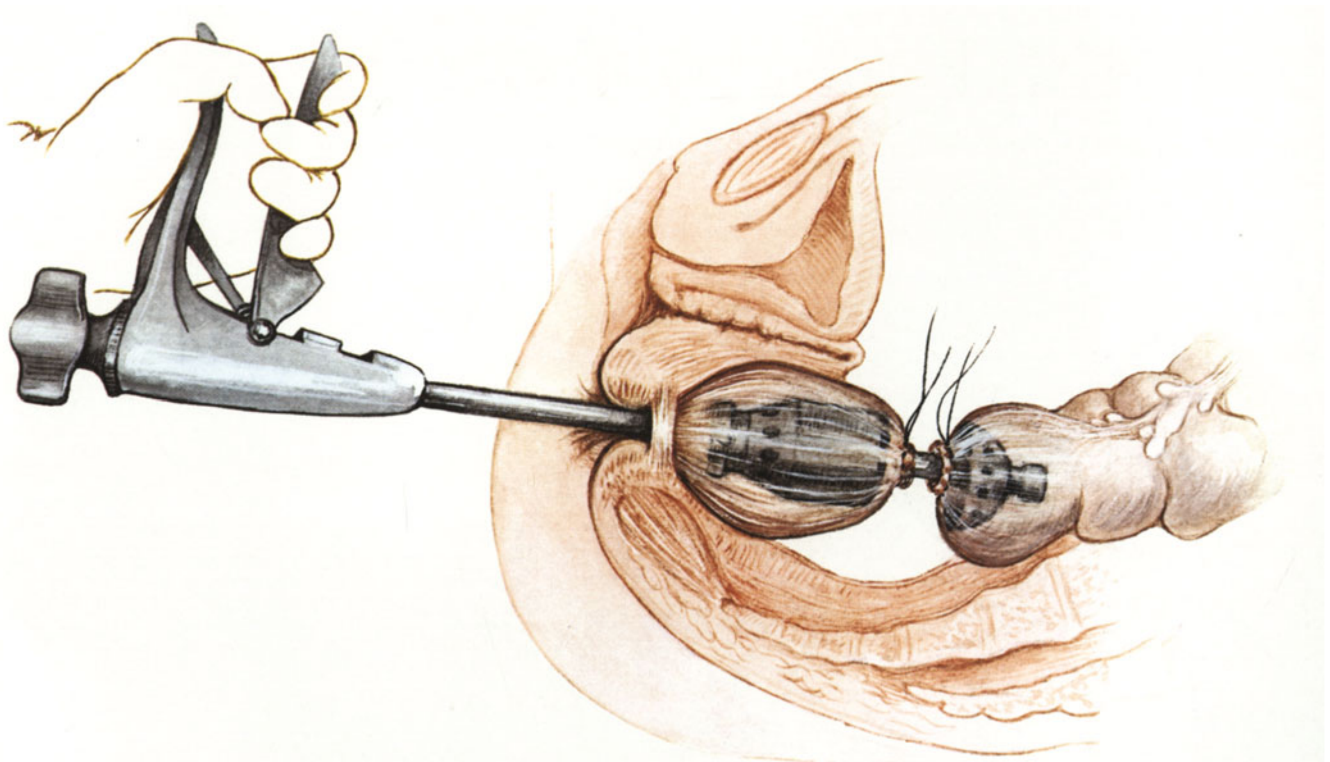


FIGURE 22-24. Colorectal anastomosis with staples. Mobilize the colon so there is no tension at the anastomotic site. Place a linen-shod intestinal clamp across the lumen of the large bowel 15 cm from the resection. Place a purse-string suture with 2–0 nylon around the opening of the bowel starting at the antimesentary surface. Place a similar purse-string at the proximal rectal opening. Insert the EEA stapler through the anus and bring the proximal colon over the dome of the expanded stapler capsule. Tie the purse-string suture around the central rod. Likewise, position the distal rectum over the base of the capsule and tie the purse-string suture around the stapler rod. Close the stapler and activate the stapler-cutting device. Open the EEA staple capsule and remove the instrument through the anus. Observe the suture line for hemorrhage with a sterile sigmoidoscope. Leakage at the site can be observed by pumping air through the sigmoidoscope into the colon with the pelvis filled with normal saline.

and bypass is a much safer procedure. Choose a segment of bowel for bypass anastomosis that has no evidence of intense radiation injury and meets all the requirements of viable bowel. The anastomosis is to be free of tension, and the use of omentum to reinforce the blood supply is particularly important in this type of anastomosis. One should be very alert to various malabsorption states associated with resection and bypass in irradiated small bowel, and the stagnant loop syndrome must be watched for as well. The stagnant loop syndrome or blind loop syndrome involves vitamin B_{12} malabsorption, steatorrhea, and bacterial overgrowth in the loop of the small intestine. Certain strains of bacteria, including *Bacteroides*, are associated with this syndrome. The definitive therapy consists of antibiotics; tetracycline has been reported to be effective, as well as clindamycin.[11]

Use of Staples

Until recently suture closure of intestinal anastomoses was the standard. Increasing experience with staple closure has shown the technique to be an acceptable alternative (Fig. 22-24). Wheeless and Dorsey have reported their series of 283 stapled closures involving the large and small bowel.[14] There were no operative deaths and no cases of intestinal obstruction at the suture line. Thirty percent of those patients who underwent low anastomosis with the EEA stapler developed a mild stricture of the anastomosis between the descending colon and rectum. All patients, however, were asymptomatic. Diverting colostomies for low intestinal anastomoses were used in all patients with prior pelvic irradiation and all patients with inadequate preoperative bowel preparation. The authors concluded that staple closure offers several advantages over suture closure: less tissue trauma, improved utilization of time, and greater blood flow to the anastomosis. Experimental studies with ^{125}I infused through anastomoses closed with suture (standard two layer and Gambee single layer) and with staples demonstrate a significantly higher blood flow through the stapled anastomoses.[15]

References

1. Brunschwig C: Intestinal surgery for advanced cancer of the ovary, in Gentil F, Junqueira AC (eds): *Ovarian Cancer.* Berlin, Springler-Verlag, 1968.
2. Burns BC, Rutledge FN, Smith JP, et al: Management of ovarian carcinoma. *Am J Obstet Gynecol* 1967; 98:374–386.
3. Chassin JL: Transverse colostomy, in *Operative Strategy in General Surgery: An Expositive Atlas.* Vol. I, New York, Springer-Verlag, 1980, ch 39.
4. Clarke JS, Condon RE, Bartlett JG, et al: Preoperative oral antibiotics reduce septic complications of colon operations. *Ann Surg* 1977; 186:251–259.
5. Committee on Pre- and Postoperative Care, American College of Surgeons: *Manual of Preoperative and Postoperative Care.* Philadelphia, Saunders, 1971, ch 19.
6. Cooper P: Abdominal trauma, penetrating and nonpenetrating, in *The Craft of Surgery.* Boston, Little Brown & Co, 1971.
7. Goldring J, McNaught W, Scott A, et al: Prophylactic oral antimicrobial agents in elective colonic surgery. *Lancet* 1975; 2:997–1000.
8. Graham JB, Villalba RJ: Damage to the small intestine by radiotherapy. *Surg Obstet Gynecol* 1963; 116:665–668.
9. Irvin TT, Hayter CJ, Warren KE, et al: The effect of intestinal preparation on fluid and electrolyte balance. *Br J Surg* 1973; 60:484–488.
10. Peacock EE, Van Winkle W: Healing and Repair of Viscera, in *Wound Repair.* Philadelphia, Saunders, 1976, ch 12.
11. Swan RW: Stagnant loop syndrome resulting from small-bowel irradiation injury and intestinal by-pass. *Gynecol Oncol* 1974; 2:441–445.

12. Trimpi H, Khubchandani IT, Sheets JA, et al: Advances in intestinal anastomosis. *Dis Colon Rectum* 1977; 20:107–117.
13. Wheeless CR: Small bowel bypass for complications related to pelvic malignancy. *Obstet Gynecol* 1973; 42:661–666.
14. Wheeless CR, Dorsey JH: Use of the automatic surgical stapler for intestinal anastomosis associated with gynecologic malignancy: Review of 283 procedures. *Gynecol Oncol* 1981; 11:1–7.
15. Wheeless CR, Smith JJ: A comparison of the flow of iodine^{125} through three different intestinal anastomoses: Standard, Gambee, and stapler. *Obstet Gynecol* 1983; 62:513–518.

Incidental Appendectomy

23

Removal of the normal appendix during abdominal pelvic surgery has been carefully studied for a number of years. Waters, in 1977, reviewed his personal experience with 830 patients in whom elective appendectomy was performed.[5] He found no increase in morbidity or mortality, with an appendectomy rate of 47% in abdominal hysterectomies performed over a 47-year period. Others have noted no increase in morbidity or mortality in incidental appendectomy in trauma cases[3] or with vaginal hysterectomy, ectopic pregnancy, and cesarean section.[1,2,5] Removal of the appendix when the patient is explored and is found to have acute pelvic inflammatory disease likewise does not increase mortality or morbidity rates over those for acute pelvic inflammatory disease managed without appendectomy.[4]

Incidental appendectomy is contraindicated in cases with poor exposure and in the patient in whom the additional 10 minutes of operating time would pose some risk.

Whereas some have suggested inversion of the appendix when the patient has free blood in the peritoneal cavity, such as with cesarean section, others have found simple crushing and ligation of the stump to be equal to inversion and treatment of the stump with phenol and alcohol.[5] The author has inverted the stump with a single Z-stitch or purse-string for a number of years and no complications have been noted in a large series of varied pelvic and abdominal surgical procedures (Figs. 23-1 through 23-3).

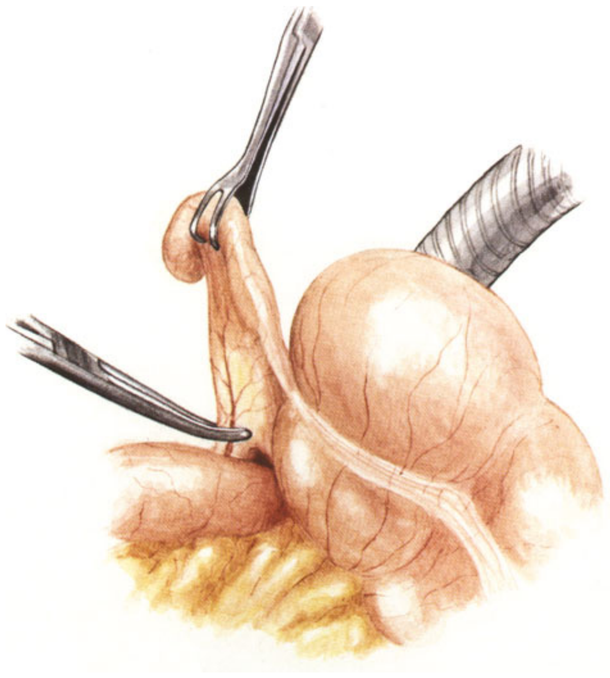


FIGURE 23-1. Pull the appendix well into the wound, isolate the appendiceal mesentery, and place a Gemini clamp through the mesentery; ligate the appendiceal mesentery with 3–0 absorbable suture and then cut the mesentery. Should an additional vessel be present, it may be clamped and carefully ligated.

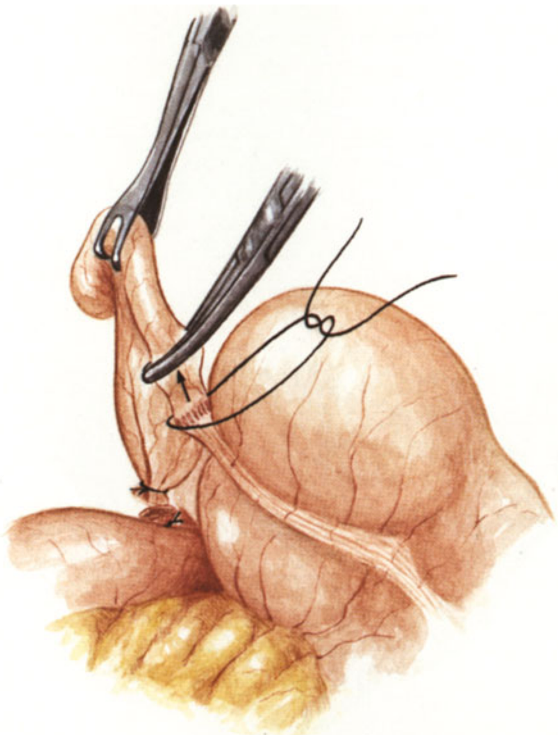


FIGURE 23-2. Place a straight clamp across the base of the appendix; crush the base and move the clamp 5 mm distal on the appendix. Tie the crushed area of the appendix with 2–0 absorbable and cut sharply along the margin of the straight clamp.

FIGURE 23-3. Place a purse-string suture of 4–0 absorbable about the stump. Grasp the stump with a small straight clamp and invert into the cecum. Do not grasp the tie around the appendix as it may loosen, producing an open appendiceal stump. Tie the purse-string to approximate serosa over the defect. After the cecum is replaced in its normal position, check the appendiceal mesentery again for bleeding. Occasionally tension will prevent blood flow in the mesentery, which will become apparent when tension is removed from the right colon and ileocecal arteries.

References

1. Cromartie AD, Kovalcik PJ: Incidental appendectomy at the time of surgery for ectopic pregnancy. *Am J Surg* 1980; 139:244–246.
2. Massoudnia N: Incidental appendectomy in vaginal surgery. *Int Surg* 1975; 60:89–96.
3. Strom PR, Turkleson ML, Stone HH: Safety of incidental appendectomy. *Am J Surg* 1983; 145:819–822.
4. Thal ER, Guzzetta PC, Kurpski WC, et al: Morbidity of appendectomy in patients with acute salpingitis. *Am Surg* 1977; 43:403–406.
5. Waters EG: Elective appendectomy with abdominal and pelvic surgery. *Obstet Gynecol* 1977; 50:511–517.

24 Genuine Stress Incontinence: A Plan of Evaluation and Management

J. Andrew Fantl

The purpose of this chapter is to describe the author's evaluation and surgical approach to genuine stress incontinence. Although special assessment techniques are incorporated, it is not the intention to present an extensive review of urodynamics. A brief description of the Burch colposuspension procedure is incorporated, with emphasis on specific surgical objectives.

Evaluation

Genuine stress incontinence is a condition by which involuntary urine loss occurs as a result of a rise in intra-abdominal pressure. The basic pathophysiologic mechanism is represented by an incompetent urethral sphincteric mechanism. Such urethral incompetence usually becomes clinically evident only during exertion, but may on occasion be persistant (continuous leakage). The evaluation of this condition has three main objectives: (1) to rule out other causes of stress incontinence, (2) to confirm the presence of urethral incompetence, and (3) to analyze the factors leading to a deficient sphincteric mechanism.

An accurate and incisive history and physical examination remains the basis of the diagnosis. It is apparent, though, that overlap of symptoms and signs occurs in a significant number of cases. In such circumstances urodynamic assessment should be considered and becomes especially desirable if surgical intervention is anticipated.

"Stress incontinence" is a symptom. It represents the patient's own perception of involuntary urine loss occurring during exertion: "If I cough (stress), I leak urine." Although in most clinical cases this symptom will correlate with objective evidence of urethral incompetence, in some it will not (Table 24-1). Patients with an unstable bladder may experience involuntary contractions only after a provocative maneuver such as a cough or a heel bounce. An acontractile bladder with a large urine volume may leak through the urethra predominantly during exertion. A small fistula and the distal end of an ectopic ureter may have a mucosal valve mechanism and become symptomatic only during the Valsalva maneuver. Lastly, a diverticulum may open below the segment of maximal closure pressure and empty during exertion, or the urethra may abruptly lose resistance (urethral instability). Sensory symptoms such as urinary frequency, urge incontinence, nocturia, and sensation of incomplete voiding are common in cases of urinary tract infections and in dysfunctional syndromes of urethra and bladder. They are, however, also observed in 40% to 50% of patients with genuine stress incontinence.

Data on past medical and surgical history may disclose conditions that may either cause or lead to urinary symptoms. Previous injuries or surgical interventions should be carefully assessed as to their possible correlation with the actual urinary symptomatology. Drugs used for concomitant medical conditions may affect bladder and urethral function. These should also be considered as possible causative or aggravating factors. A variety of causative factors should be considered and their impact properly assessed (Table 24-2).

During physical examination, special attention should be placed on assessing both genital and lower urinary tracts. Inspection of the urethral meatus and vaginal walls is best accomplished with a Sim's speculum (Fig. 24-1). It allows ample visualization and does not introduce artifact. Observation of the anterior vaginal wall should be followed by palpation of the bladder base and urethra. A urethral diverticular sac, a vesicovaginal fistula, or an ectopic urethral orifice may become apparent during this step of the examination. Careful assessment of pelvic relaxation should be noted at rest and during maximal straining effort. Bimanual examination must determine uterine and adnexal conditions as well as ascertain the possible existence of an overdistended bladder (overflow incontinence). Prior to completion of pelvic examination, the integrity of the S2-S4 reflex arc can be determined by eliciting the bulbocavernosus reflex (Fig. 24-2).

Table 24-1. Conditions Other Than Genuine Stress Incontinence Which May Clinically Present with the Symptom of Stress Incontinence

Detrusor instability
Detrusor acontractility (overflow incontinence)
Genitourinary fistula
Urethral diverticulum
Ectopic ureter
Urethral instability

Urodynamics

In suspected cases of genuine stress incontinence, the main goal of urodynamic assessment is to determine detrusor stability and confirm urethral sphincteric incompetence.

Table 24-2. Factors That Can Contribute to the Condition of Genuine Stress Incontinence

Increased abdominal pressure
Abdominopelvic tumors
Obesity
Chronic pulmonary disease
Bladder overdistention
Neuropathic (overflow incontinence)
Infrequent voiding syndrome
Urethral incompetence
Decreased intrinsic sphincteric mechanism
Hypoestrogenism
Periurethral fibrosis
Denervation
α-Adrenergic blockade
β-Adrenergic stimulation
Trauma
Decreased or absent pressure transmission capacity
Decreased or absent reflex striated muscle contraction

From Fantl JA: Genuine stress incontinence, in Sciarra J (ed): *Gynecology and Obstetrics.* Philadelphia, Harper & Row, 1984, vol 1, chapter 85.

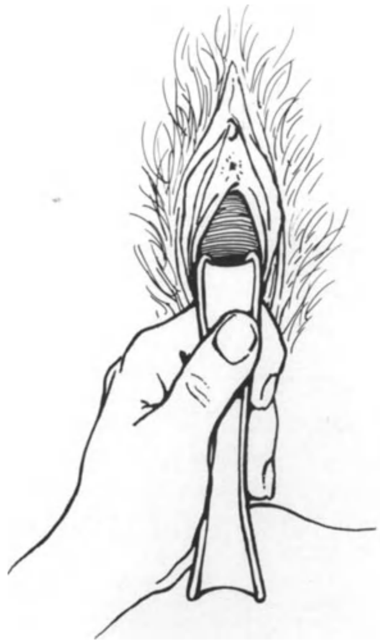


FIGURE 24-1. A Sim's speculum is demonstrated. The anterior vaginal wall can be visualized without retraction of the lateral walls.

FIGURE 24-2. Bulbocavernosus reflex. A gentle stroke with a Q-tip or a sponge to the labia or clitoris induces a contraction of the anal sphincter. At times the anal contraction is better palpated than observed.

Determination of Detrusor Stability

Cystometry. Prior to instrumentation all patients should be screened for urinary tract infection, which not only may yield erroneous urodynamic information, but may introduce bacteremia. Cystometry evaluates detrusor function during bladder filling. It objectively assesses the relationship between bladder volume and pressure. Various techniques have been described, and the degree of complexity depends on the availability of instrumentation. *Subtracted provocative cystometry* is utilized in the author's institution. A dual microtip pressure transducer with lumen is placed in the urethra and bladder. Simultaneous recording of intra-abdominal pressure is recorded through an independent catheter placed in the rectum. Subtraction of intra-abdominal pressure from intervesical pressure allows the determination of the detrusor pressure (subtracted cystometry). The patient is studied supine and erect, at rest, and during provocative maneuvers such as coughing or heel bouncing (provocative cystometry). Pressures are recorded in a multichannel strip (Fig. 24-3). Several objective and subjective data are obtained.

1. First Sensation to Void (FSV): This usually occurs at 150 to 200 cc and represents an indication of bladder sensation. It represents a gross estimation as significant variations within individuals have been observed.

2. Maximal Cystometric Capacity (MCC): Represents the volume at which the bladder feels full. In most female individuals, MCC is reached at 500 to 700 cc. Significant reduction or increments warrant further urologic or neurologic assessment.

3. Compliance: Represents the relationship between bladder volume and pressure: $C = \Delta V / \Delta P$. Significant decrease in compliance may indicate intrinsic detrusor pathology (radiation cystitis).

4. Contractility: A normal detrusor should not contract involuntarily during

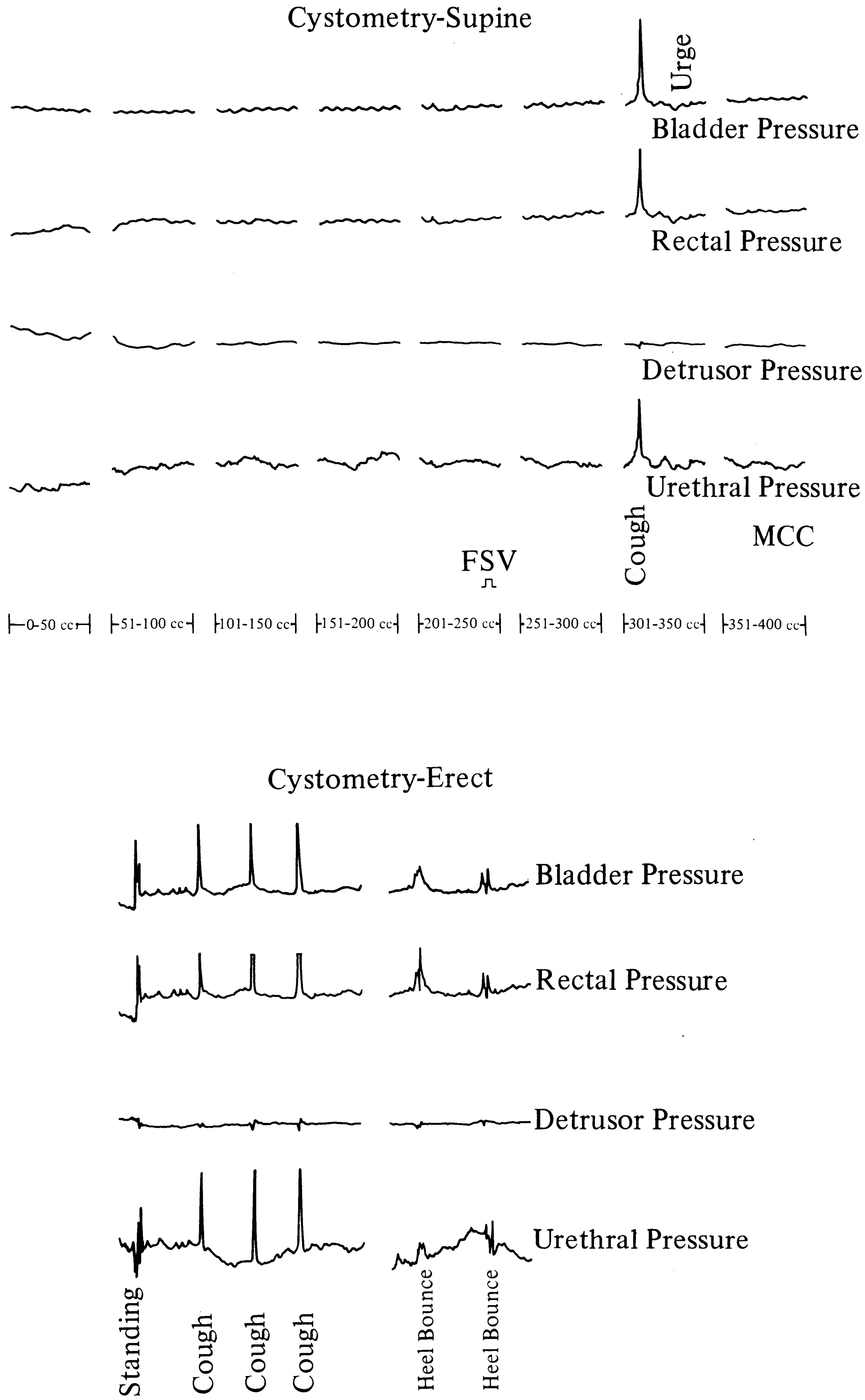


FIGURE 24-3. Subtracted provocative cystometry (supine and erect). Bladder, rectal (transabdominal), detrusor, and urethral pressure are simultaneously obtained while the bladder is being filled. Filling is done through a lumen present in the dual microtip catheter. Rate of filling is 50 cc/minute and is regulated by a water pump. The first sensation to void (FSV) is noted at volume 201 to 250 cc. Maximal cystometric capacity (MCC) is noted at 400 cc. The bladder is filled in the supine position. Provocation is done supine through a cough and erect through repetitive coughs and heel bounces. Detrusor pressure derives from the subtraction of the transrectal pressure from the intravesical pressure. There is no evidence of instability.

filling either at rest or after provocation. Such physiologic condition is referred to as *detrusor stability.* The presence of abnormal involuntary bladder contractions (detrusor instability) has been reported in 15% to 25% of women with urinary incontinence. The syndrome as previously mentioned may clinically mimic genuine stress incontinence.

Determination of Sphincteric Incompetence

The urethra represents the sphincter of the bladder. At rest, the urethral resistance derives from its various anatomic components. It is believed that about a third of the sphincter function is due to the striated musculature, a third to the smooth musculature, and the same proportion from connective-elastic tissues and vasculature. When a pressure-transducer is withdrawn along the urethra, a urethral pressure profile (UPP) is obtained. This can be related to the concomitant bladder pressure and is interpreted as a closing pressure or *urethral closing pressure profile* (UCPP). Such a determination, when done at rest, is referred to as a *passive UCPP* (Fig. 24-4). The clinical values of the functional urethral length (FUL) and maximal urethral closing pressures (MUCP) are still debated but represent objective information of the urethral sphincter function at rest. The MUCP is known to significantly decrease with age. Other causes include periurethral fibrosis, hypoestrogenism, and alpha-adrenergic blocking agents. Specific values representing urethra competence or incompetence are not available and may well not exist. The data derived from passive profilometry should be used in conjunction with other urodynamic and clinical information.

Sphincter competence or incompetence during exertion can be assessed by different techniques that vary from direct observation to complex urodynamic assessment. Two useful techniques are the following:

1. Direct Observation or Stress Test: With the patient in the supine position (urethral meatus visible), she is asked to cough with a bladder filled to cystometric capacity. If a spurt of fluid is ejected from the urethra at the time of

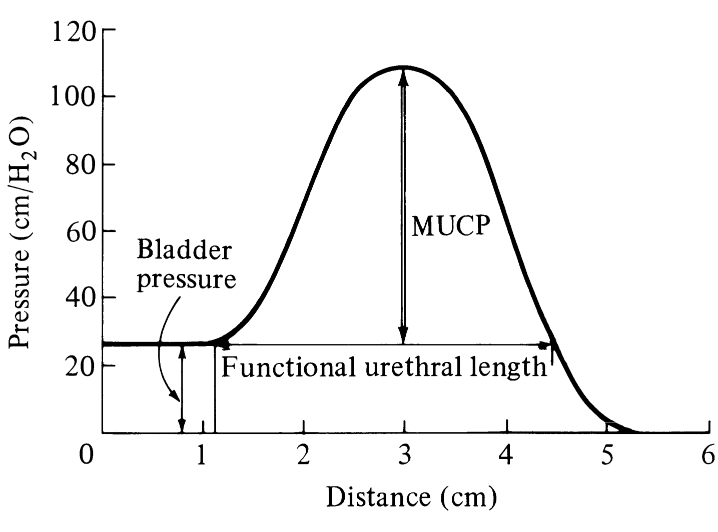


FIGURE 24-4. Passive urethral pressure profile (UCPP). MUCP indicated maximal urethral closing pressure. This is the maximal pressure in the urethra in excess of that present in the bladder. Functional urethral length indicates the length of the urethra in which the urethral pressure is greater than in the bladder. (Adapted from Bates P, Bradley WE, Glen E, et al: The standardization of terminology of lower urinary tract function. *J Urology* 121:551–554, 1979).

the cough, the diagnosis of sphincteric incompetence is made (Fig. 24-5). Should the meatus not be visible (erect position) or if dribble or stream loss is induced, the test is labeled "questionable" and further sphincteric assessment is indicated.

2. Dynamic UCPP: Repetitive coughing during passive urethral profilometry results in a dynamic UCPP. Electronic subtraction of the pressure transmitted to the bladder from that transmitted to the urethra is obtained. If the pressure generated by the cough induces less pressure in the urethra than in the bladder, that segment of the urethra is considered incompetent (Fig. 24-6, Pre-Op).

Lack of equal transmission of intra-abdominal pressure to the urethra and bladder is usually believed to occur because of excessive mobility of the urethral axis. At the acme of a Valsalva maneuver the proximal urethral prolapses under the pelvic diaphragm, and the generated abdominal pressure does not equally transmit to the urethra. When urethral axial hypermobility does not exist, sphincteric competence may also be impaired. But in such circumstances intrinsic sphincter dysfunction rather than axial hypermobility is the cause of the sphincteric incompetence. Hypermobility and intrinsic dysfunction may coexist, and their individual significance in particular cases represents a diagnostic dilemma.

FIGURE 24-5. Direct observation of urethral sphincteric incompetence. A spurt of urine is seen expelled through the urethra during Valsalva maneuver (From Fantl JA: Genuine stress incontinence, in Sciarra J (ed): *Gynecology and Obstetrics.* Philadelphia, Harper & Row, 1984, vol 1, chapter 85).

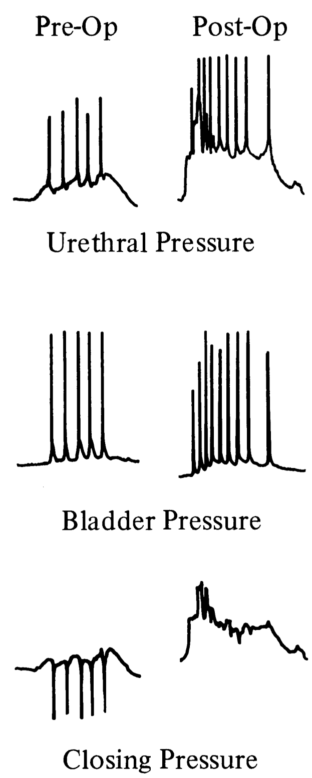


FIGURE 24-6. Dynamic urethral closing pressure profile. Instantaneous electronic subtraction of bladder pressure from the urethral pressure during coughs indicates that the urethra is incompetent. This is objectively demonstrated preoperatively by the negative deflections observed in the closing pressure profile. Transmission of pressure to the urethra seems inappropriate. Postoperatively, it is shown that the sphincter becomes competent as transmission of pressure to the proximal urethra has been corrected.

Urethrocystoscopy. Endoscopy of the urethra and bladder should be done when sensory symptomatology is present and especially when either diverticulum or fistula need to be ruled out. *Radiographic* studies are usually done in cases where surgical intervention is anticipated. Metallic bead chain cystourethrovaginograms are considered useful in depicting anatomic relationships between the bladder, urethra, and vaginal canal, specifically the relation of the urethrovesical junction to the anterior vaginal wall. This differs substantially from individual to individual and is considered important preoperative information. However, the technique is not considered useful in differentiating types or mechanisms of incontinence. In addition, significant inconsistency in interpretation has been noted when radiographs are read by independent observers.[1] This radiographic technique may be useful in planning surgical strategy and in examining the roentogenographic anatomy in cases of operative failure.

Surgical Management Plan

The impact or significance of genuine stress incontinence varies with each individual. Social, hygienic, and personal standards determine the degree of disability in each individual. Intervention, therefore, should be individually designed. In recent years the author has had an increase in requests for "absolute continence" in young patients whose profession includes vigorous and strenuous exercises inducing minimal but extremely bothersome incontinence.

The surgical management should always be directed to the underlying pathophysiologic mechanism. In cases where urethral incompetence is secondary to hypermobility, the surgical objective is to reposition the proximal urethra within the abdominal cavity (repositional surgery). In most of these cases clinical and urodynamic information indicate good intrinsic urethral function, but poor transmission or pressure due to prolapse of the urethra under the pelvic diaphragm. Most primary cases of genuine stress incontinence are induced by such anatomic circumstances. Urethral repositioning without urethral obstruction is satisfactorily accomplished by the Burch colposuspension technique as illustrated in Figs. 24-7 through 24-9. One should note that

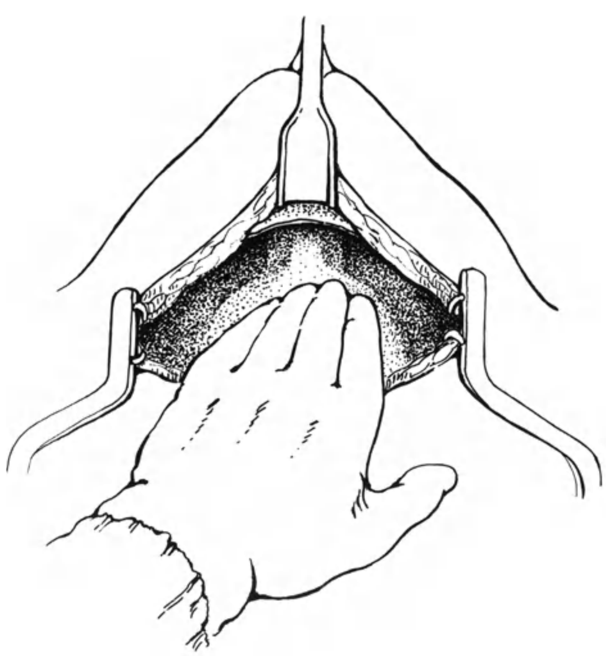


FIGURE 24-7. Burch colposuspension. The Retzius space is shown to be entered. The silhouette of the bladder and urethra is depicted against the silhouette of the vaginal canal.

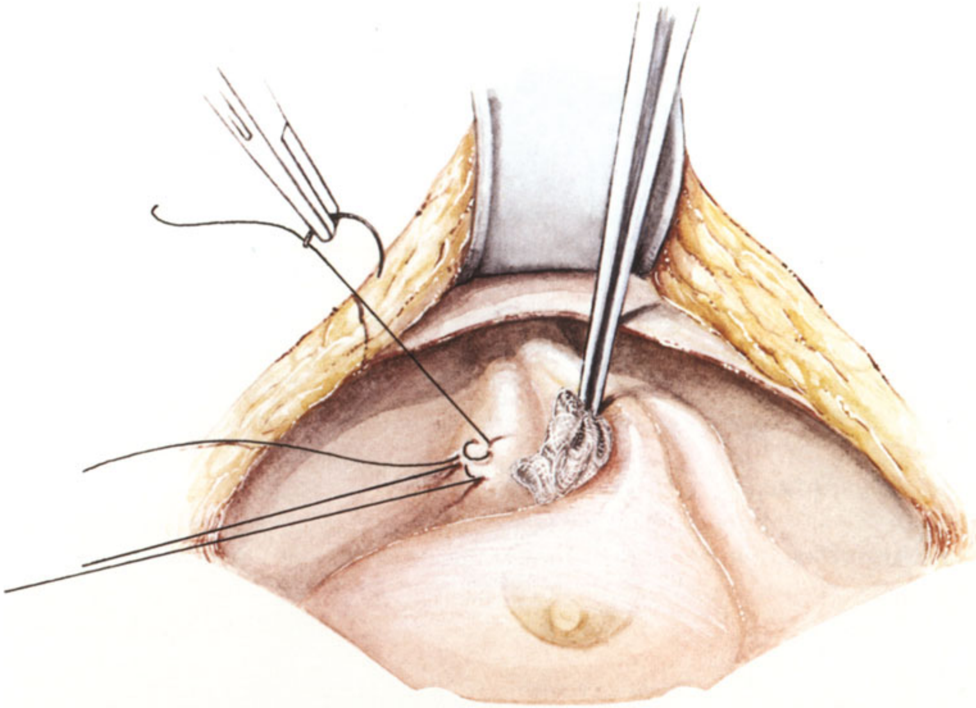


FIGURE 24-8. Burch colposuspension. Sutures are placed in the paravaginal tissue lateral to the urethrovesical junction. Double "take" for each suture should secure proper grasp of the tissue.

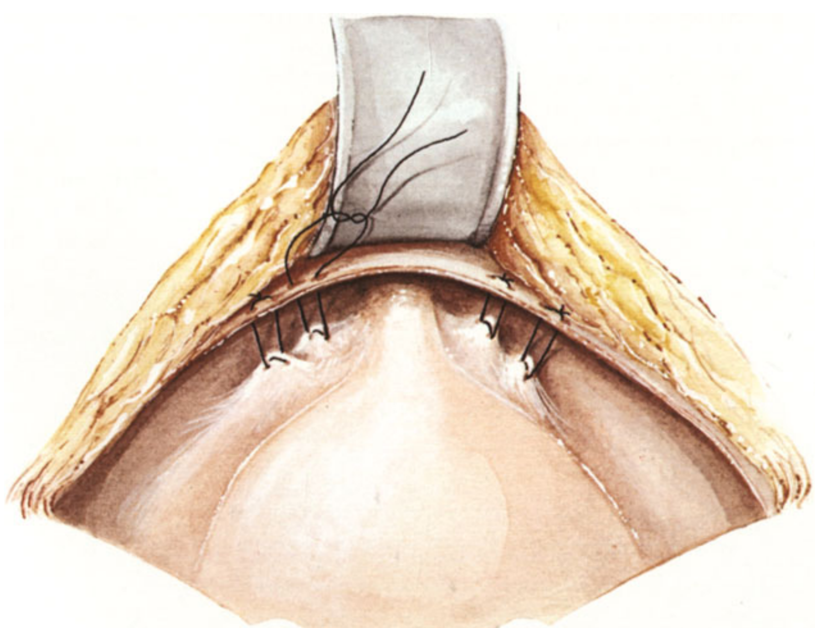


FIGURE 24-9. Burch colposuspension. The sutures are anchored to Cooper's ligament on both sides. Note that incomplete opposition against the iliopectineal line is preventing urethral compression against the symphysis pubis.

this technique represents an endogenous sling operation where the vaginal tissue is suspended and the urethra is repositioned. By not attempting to oppose the vaginal tissue directly against Cooper's ligament, urethral compression against the symphysis pubis can be avoided.

When sphincteric incompetence is due to intrinsic sphincteric dysfunction, as in cases of periurethral fibrosis, surgery attempts to purposely compress the urethra and produce obstruction. Under those circumstances, it is expected to produce some degree of micturition dysfunction. The surgeon should carefully evaluate the voiding phase of micturition preoperatively and warn the patient of possible postoperative micturition difficulties. Several techniques can be used to accomplish this objective. Fascia sling procedures or other heterologous materials have been employed. The author has obtained good results using the Burch colposuspension as an obstructive procedure as well. When such objective is desired, then maximal compression should be attempted. Good vaginal mobility is needed.

Successful management of genuine stress incontinence is based on adequate preoperative evaluation, selection of the appropriate surgical technique, and skillful operative performance.

References

1. Fantl JA, Beachley MC, Bosch HA, Konerding KF, Smith PJ: Bead-chain cystourethrogram: An Evaluation. *Obstet Gynecol* 1981; 58:237–240.

Selected Bibliography

Aldridge AH: Transplantation of fascia for relief of urinary stress incontinence. *Am J Obstet Gynecol* 1942; 44:398–411.

Bates CP, Bradley WE, Glen ES, et al: Fourth report on the standardization of terminology of lower urinary tract function: Terminology related to neuromuscular dysfunction of the lower urinary tract. *Br J Urol* 1981; 53:333–335.

Burch JC: Urethrovaginal fixation to Cooper's ligament for correction of stress incontinence, cystocele and prolapse. *Am J Obstet Gynecol* 1961; 81:281–290.

Fantl JA: Genuine stress incontinence, in Sciarra J (ed): *Gynecology and Obstetrics.* Philadelphia, Harper & Row, 1984, vol 1, chap 85.

McGuire E: Urethral sphincter mechanisms. *Urol Clin North Am* 1979; 6:39–49.

Morgan JE: A sling operation, using Marlex polypropylene mesh, for treatment of recurrent stress incontinence. *Am J Obstet Gynecol* 1970; 106:369–377.

Rud T, Andersson KE, Asmussen M, et al: Factors maintaining the intraurethral pressure in women. *Invest Urol* 1980; 17:343–347.

Turner-Warwick R: Observations on the function and dysfunction of the sphincter and detrusor mechanisms. *Urol Clin North Am* 1979; 6:13–30.

Westby M, Asmussen M, Ulmsten U: Location of maximum intraurethral pressure related to urogenital diaphragm in the female subject as studied by simultaneous urethrocystometry and voiding urethrosystography. *Am J Obstet Gynecol* 1982; 144:408–412.

Marshall-Marchetti-Krantz Procedure

25

Kermit E. Krantz

True anatomic stress incontinence accounts for roughly three fourths of all female urinary incontinence and should be relieved by a properly selected and executed surgical procedure in 90% of patients. However, approximately one fourth of women who complain of uncontrollable loss of urine do not have anatomic stress incontinence, but one of several other conditions that adversely affect the continence mechanism, including urgency incontinence, bladder neuropathies, congenital or acquired urinary tract anomalies, psychogenic incontinence, and "detrussor" dyssynergia. Therefore, a careful differential diagnosis of all the various abnormalities leading to urinary incontinence is mandatory before concluding that surgical correction is indicated.

Urinary stress incontinence is the involuntary loss of an embarrassing amount of urine through an intact urethra as a result of sudden increases in intra-abdominal pressure. In pure anatomic incontinence, urine is not lost as a result of bladder muscle contraction, and the imminency of urinary loss is not preceded by the sensation of urinary urgency. Patients with anatomic incontinence experience loss of urine in spurts, synchronous with and ending abruptly after the peak of increased intra-abdominal pressure. Patients suffering from bladder neuropathies have quite different symptoms. These patients tend to dribble or leak urine during and after stress, often with a lag time of 10 to 20 seconds. Furthermore, the instability may be accentuated by exposing such patients to the sound of running water, immersing their hands in water, or having them assume the erect position with bladder full. Accordingly, a careful, well-organized history is extremely important as a part of the diagnostic workup. By adhering to a rigid definition of true stress incontinence as immediate loss of urine without warning upon coughing, sneezing, laughing, or other activities that may result in an increase in intra-abdominal pressure, performance of unnecessary preoperative procedures may be avoided.

Physiology

Urinary continence is a function of suppression of the innate tendency of the smooth muscle of the bladder to contract as the bladder fills and the ability of the urethra and vesical neck to remain closed except during voluntary voiding, thereby preventing accidental leakage of urine during times of increased abdominal pressure. In relation to one another, the urethra and the bladder function much like a torque system. The mechanical advantage of such a system is defined as the ratio of load to force (L/F) and is equal to the inverse ratio of the torque arms. Balance is achieved by multiplying the load times the length of one segment, which in turn equals the load times the length of the other segment. As applied to the urethra and bladder, the fulcrum of the torque is at the external urethral meatus, force is at the vesical neck near the puboprostatic (pubourethral) ligaments and the levator ani muscles, and load equals the capacity of the bladder or the volume of urine it contains. The distance of the first segment is measured from the fulcrum to the point of force as distance *A-F.* The second segment is measured from the fulcrum to the base of the bladder or load as distance *A-L.*

Normally, segments *A-F* and *A-L* are the same length, and utilizing the anterior vaginal wall as a horizontal plane of reference, the angle of function is approximately 35 degrees. If the urethra is of normal length (3.5 to 5.25 cm), function of the system will depend on the balance between or the ratio of the puboprostatic ligaments and the puborectalis muscle (F) to urine volume in the bladder (L) and the tonus advantage of the smooth outer circumferential muscle of the urethra over the inner longitudinal muscle fibers. However, increased intra-abdominal pressure as a result of closure of the glottis and contraction of the abdominal musculature, with concomitant contracture of all the smooth muscle of the bladder and the urethra, results in a markedly increased load factor. This condition in turn results in the puboprostatic ligaments being forced downward toward the horizontal, and if the ratio of load to force becomes greater than 1, balance of the system is lost. Moreover, as the smooth longitudinal muscle of the urethra contracts, an additional reduction in the capacity of the puboprostatic ligaments occurs, decreasing the length of the urethra, making the hypotenuse of the triangle equal to the base, and reducing the angle of function to zero. With contraction of the bladder musculature adding to the load, urine is expressed via the only direction available, through the urethra to the outside. Any factor—the length of the urethra, a weakness in the puboprostatic ligaments or adjacent levator ani muscles, overdistention of the bladder as measured by the load factor, or a decrease in the angle of the urethra—may singularly or collectively contribute to stress incontinence.

Preoperative Evaluation

Physical examination is an important facet of preoperative evaluation. Urethral detachment should be demonstrated during physical examination, and the physician should be alert to the presence of a cystocele, urethral diverticula, vaginal scarring, or other abnormalities. However, because there is a considerable overlap among the symptoms associated with common causes of urinary incontinence, objective testing is necessary as a confirmatory measure. A comprehensive discussion of urodynamic assessment is found in Chapter 24.

Operative Strategy

A variety of vaginal and abdominal operations have been devised over the years for the correction of urinary stress incontinence. Nearly all, however, are designed to restore the normal urethrovesical anatomic relationship.

In 1949 Marshall, Marchetti, and Krantz described a urethrovesical suspension in a 54-year-old man who had developed urinary stress incontinence following an abdominal perineal resection; they also reported a subsequent 82% success rate performing the same procedure on 44 women who had urinary stress incontinence.[3]

The author has gradually modified the original operation over his more than 30 years of clinical practice. The use of multiple absorbable sutures has been discarded and now only one nonabsorbable suture is used on each side of the urethrovesical junction. The cystopexy has also been discarded as it contributes little to success.

Precise suture placement and permanent fixation are the critical factors and the cornerstones of long-term success in surgery for stress incontinence. Many of the author's patients have been referrals whose suprapubic urethral suspension operations of one type or another had failed. Some patients have persistent urinary leakage because of nonanatomic types of incontinence and were selection errors. Another group did have anatomic incontinence, but at reoperation were found to have little or no scarring in the area of the urethrovesical junction. Often the anterior bladder was densely adherent to the symphysis in these patients.

The patient is placed in a low dorsolithotomy position, allowing the surgeon to operate with one hand in the vagina and the other suprapubically in the space of Retzuis. After standard preparation solutions have been applied to both the vagina and the hypogastric and ilioinguinal regions, the patient is draped in a fashion permitting easy access to the lower abdomen and the introitus. A size 20 Foley catheter with a 5-mL bag is inserted into the bladder through a plastic drape placed over the abdominoperineal area. The procedure is illustrated in Figs. 25-1 through 25-4.

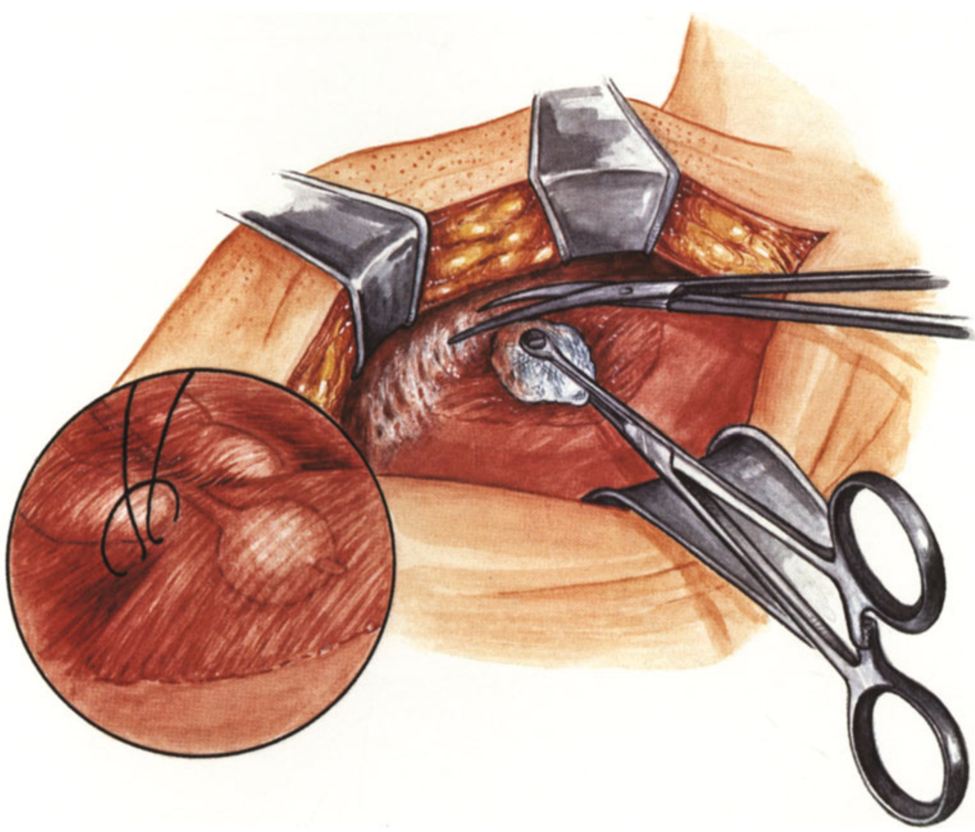


FIGURE 25-1. Make a Pfannenstiel incision in the abdomen and carry the incision through the subcutaneous tissue and fascia with sharp dissection. Separate the rectus muscles in the midline and tent and divide the posterior fascia. Place approximately 100 mL diluted methylene blue in the bladder through the Foley catheter and clamp the Foley until the end of the procedure. Dissect the space of Retzius and identify the vesical neck and urethra. Keep the balloon of the Foley catheter at the vesical neck by mild traction of the catheter. *Inset:* With the tips of the index and middle fingers of the assistant elevating the anterior vaginal wall on each side of the proximal urethra, make a double bite of the vaginal wall with 2–0 Mersilene on each side of the urethra at the region of the vesical neck (urethrovesical angle).

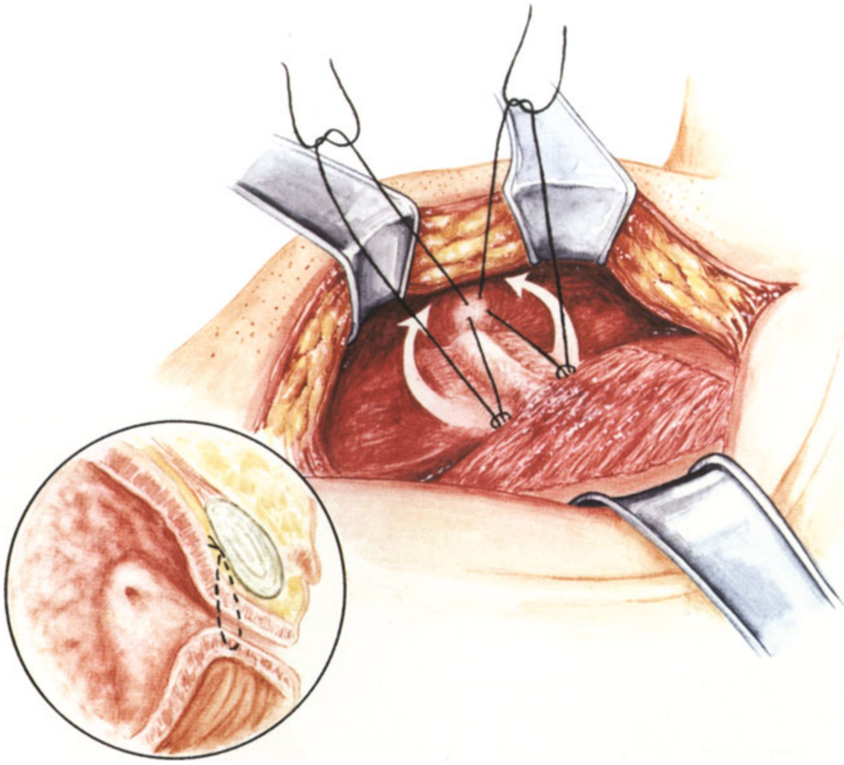


FIGURE 25-2. Anchor the sutures to the periosteum on the posterior surface of the symphysis pubis, elevating the urethrovesical junction with the index and third fingers, and tie the suture to immobilize it. If there is venous bleeding it is controlled by pressure with a sponge stick. After satisfactory hemostasis, approximate the rectus abdominis muscles with a horizontal mattress suture of 2–0 chromic gut. Close the rectus sheath with an interlocking suture of 2–0 absorbable suture. Close the subcutaneous tissue with a 3–0 chromic gut placed in Scarpa's fascia, and close the skin with a subcuticular stitch of 4–0 absorbable suture or 5–0 nylon. These sutures are removed in six days.

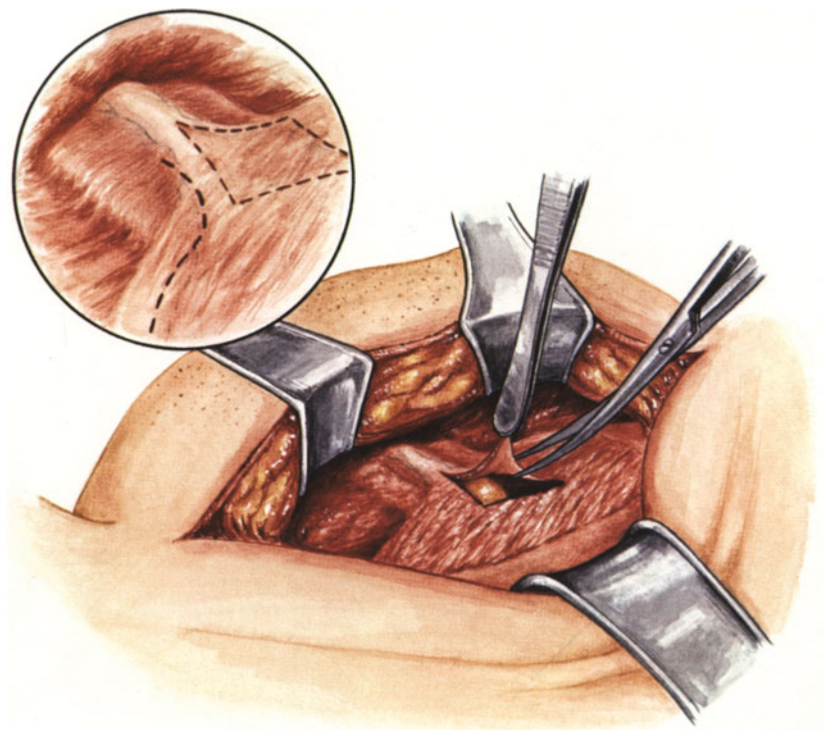


FIGURE 25-3. Urethral lengthening is indicated in those patients who are operative failures and have a good urethrovesical angle, have a urethral length of 1.4 cm or less, and are incontinent with a volume greater than 100 to 125 mL. Such patients have usually had multiple vaginal and abdominal operations. *Dotted line:* new urethral position. *Inset:* Resect the area shown to lengthen the urethra anatomically. Make the incision by cutting or resecting a diamond-shaped piece of urethrovesical wall. The muscularis and mucosal apex in the urethrovesical junction extend laterally, terminating approximately 1 to 2.5 cm from the origin.

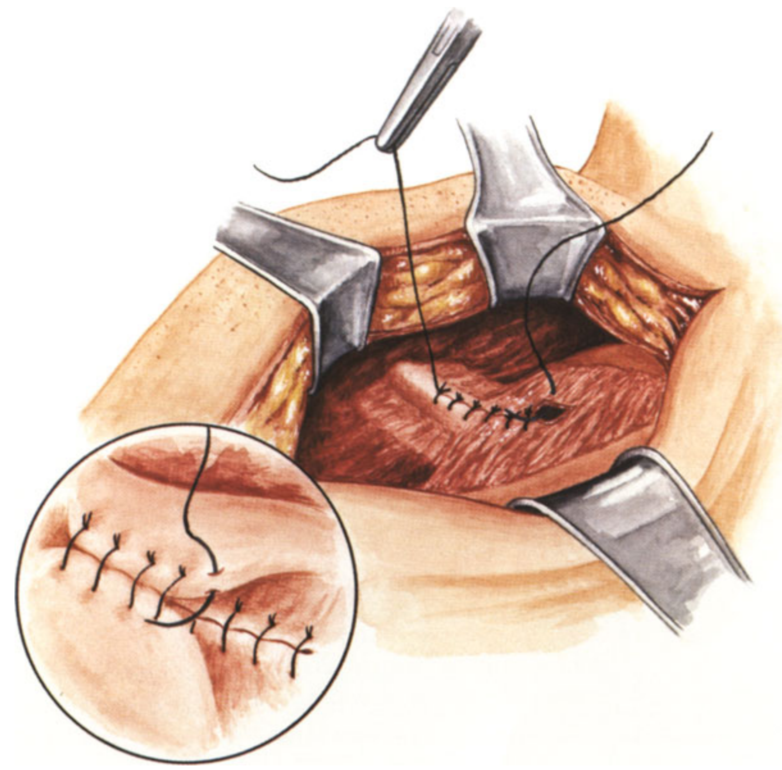


FIGURE 25-4. After the diamond-shaped tissue has been removed, close the mucosa with continuous or interrupted 4–0 chromic sutures. Note that the sutures are retromucosal and do not enter into the bladder. Place the second layer of interrupted sutures in the muscularis with 3–0 or 4–0 sutures. The urethra measured should increase 1 cm in length with the Foley bulb in place. Proceed with the urethral suspension, preferably using 2–0 chromic gut suture.

Postoperative Management

Following surgery the vagina is packed with gauze to help reduce hematomas and disruption of the operation due to postanesthetic coughing. The packing is removed when the patient is fully awake. Various methods of bladder drainage with urethral suspension have been tried over the years. Foley catheters and superpubic drainage with various kinds of catheters are the most common methods. Broberg recently reported the use of a minicatheter.[1] With this method, a small No. 8 feeding tube is inserted and sutured to the urethral meatus. Broberg noted no major complications in the 29 cases reported. If the bladder is entered and repaired, the catheter is left in place until the urine is microscopically clear of blood. It may otherwise be removed on the day following surgery.

The patient is advised about straining, coughing, and lifting. When indicated, antibiotics and chemotherapeutics are employed to control infection, primarily if positive bacteriuria was present prior to surgery. In 3 to 4 weeks the patient may resume normal activity but is cautioned to refrain from lifting heavy objects. Pregnancy may be anticipated without difficulty, and vaginal delivery is not contraindicated.

Lee reviewed 549 patients followed for 2 to 16 years following an MMK procedure for urethral suspension.[2] Of the 227 primary procedures, 91% were cured or much improved, 7% were unchanged, and 2% were worse. Of the 322 patients who had persistent or recurrent stress incontinence, 90% were cured or much improved, 5.3% were unchanged, and 4.7% were worse. There were no fistulas or evidence of urethral injury even though the 322 patients with recurrent stress incontinence had an average of 2.3 unsuccessful procedures previous to the one reported. Complications included 57 patients with acute urinary tract infections and 48 patients with incisional infection. Osteitis pubis appearing 1 to 8 weeks postoperatively and consisting of adductor or inner thigh pain aggravated by coughing or walking occurred in 3.2% of the patients. This diagnosis was established by a hazy border of the pubic symphysis, and 5 of the 18 patients developed lytic changes. There was no relationship to the use of absorbable versus nonabsorbable suture material. Many patients in the re-operated group were done with the bladder open without increasing morbidity.

References

1. Broberg C: Catheter drainage after gynecologic surgery: A comparison of methods. *Am J Obstet Gynecol* 1984; 149:18–23.
2. Lee RA, Symmonds RE, Goldstein RA: Surgical complications and results of modified Marshall-Marchetti-Krantz procedure for urinary incontinence. *Obstet Gynecol* 1979; 53:447–450.
3. Marshall VT, Marchetti AA, Krantz KE: The correction of stress incontinence by simple vesico-urethral suspension. *Surg Gynecol Obstet* 1949; 88:509–518.

Selected Bibliography

Green TH: Urinary stress incontinence: Differential diagnosis, pathophysiology, and management. *Am J Obstet Gynecol* 1975; 22:368–398.

Hodgkinson CP: Stress urinary incontinence—1970. *Am J Obstet Gynecol* 1970; 108: 1141–1168.

Krantz KE: Anatomy of the urethra and anterior vaginal wall. *Am Assoc Obstet Gynecol Abdom Surg* 1950; 61:31–59.

Krantz KE: Anatomy of the urethra and anterior vaginal wall. *Am J Obstet Gynecol* 1951; 62:382–396.

Krantz KE: The anatomy and physiology of the vulva and vagina and the anatomy of the urethra and bladder, in Philipp E, Barnes J, Newton M (eds): *Scientific Foundations of Obstetrics and Gynecology.* London, Heinemann, 1970.

Marshall VT, Marchetti AA, Krantz KE: The correction of stress incontinence by simple vesico-urethral suspension. *Surg Gynecol Obstet* 1949; 88:509–518.

Shingleton HM, Davis RO: Stress incontinence in perspective. *Obstet Gynecol Dig* 1977; 19:15–25.

Ureteral Injury

26

The intimate relationship between the ureter and the female genital tract must be considered in the planning of any gynecologic surgical procedure. Preoperative intravenous pyelograms must be obtained in any patient with an abdominal mass, pelvic malignancy, or lower genital tract anomaly and are indicated in all patients undergoing hysterectomy or other major pelvic surgery. Cystoscopy, retrograde pyelography, renal scans, sonography, and other urinary studies may be needed in some instances to complete preoperative evaluation. Patients with cervical leiomyomas and endometriosis are particularly prone to ureteral injury, and the common anomaly of ureteral reduplication must always be considered.

Although ureteral injury during cesarean section is rare, Eisenkop et al noted a 0.09% incidence.[3] The injuries resulted from extension of the uterine incision into the broad ligament and subsequent attempts to achieve hemostasis. St. Martin et al found that 10.8% of patients having routine gynecologic surgical procedures had hydronephrosis and hydroureter prior to surgery and 33 of 36 resolved after pelvic operation.[13] Likewise, Conger et al noted that 12% of patients had hydronephrosis and all resolved spontaneously after operation to remove the pelvic mass or other lesion compressing the ureter.[2]

Intraoperative cystoscopy with indigo carmine administration following vaginal procedures in which ureteral injury might easily occur is recommended. The absence of a large mass, obesity, or endometriosis does not, however, provide protection against ureteral injury. Symmonds noted that most of the cases of ureteral injury resulted from "easy" abdominal hysterectomies.[14] The author consistently performs cystoscopy following vaginectomy, total vaginal prolapse repair, vesicovaginal fistula repair, and excision of vaginal cyst or urethral diverticulum. It is reassuring to see indigo carmine ejected from each ureter following such procedures. Immediate retrograde pyelography is performed if the dye fails to appear. The use of indigo carmine administration intravenously is indicated during ovarian cancer debulking, where ascitic fluid and the presence of large amounts of tumor may obscure ureteral injury.

Anuria is seen, of course, with bilateral ureteral obstructions. When the more common causes of postoperative anuria such as a clamped Foley catheter and hypovolemia have been ruled out, prompt investigation with cystoscopy and retrograde pyelograms is mandatory.

More significant than immediate detection, of course, is the prevention of the injury, and several measures are worthwhile. The use of the surgical procedures outlined in this volume will minimize ureteral injuries. They are all designed to provide early exposure of the ureters and direct visualization during operations performed near them.

Technical Considerations

Isolate the ovarian vessels with the ureter under direct visualization and use free ties instead of large clamps. Leave the ureter on the peritoneum to maintain the integrity of its blood supply and make any ligation of the hypogastric or uterine vessels distal to the origin of the small vessels, providing blood supply to the ureter if possible. Dissect the bladder down before placing any clamps on the uterine artery or paracervical tissue. Carefully locate and visualize the ureter when closing the pelvic peritoneum (Fig. 26-1).

The basic surgical technique of fine suture, small portions of tissue in clamps, delicate artery forceps, nontraumatic parametrial clamps, and maximum exposure through an adequate incision is the most significant measure in reducing ureteral injury to an absolute minimum.

One of the more common mistakes in ureter identification is confusion between it and the obliterated hypogastric artery. The ureter and this structure run a similar course, appear upon superficial inspection to be similar, and feel alike. They are differentiated by position, by the presence of periureteral vascular sheath, by the relationship between the uterine artery coursing over the ureter and arising in conjunction with the distal portion of the obliterated hypogastric artery, and by peristalsis. One elicits such peristalsis by a very gentle stroking of the ureter, taking care not to crush the ureter. The use of palpation alone for ureteral detection has misled many an experienced surgeon in situations where extensive endometriosis, ovarian cancer, severe radiation reaction, or cervical leiomyomas have grossly disturbed the normal anatomic relationships.

Many ureteral injuries in radical hysterectomy result when the delicate periureteral sheath and its anastomosis between renal aortic, hypogastric, ovarian, uterine, vaginal, and superior vesical arteries are needlessly sacrificed. Placing rubber drains on tension about the ureter and constantly elevating and manipulating them, thereby avulsing the vascular sheath, is a poor substitute for adequate exposure and leaving the ureter attached in its bed when possible. Although the use of ureteral catheters is suggested by some to prevent ureteral injury, the author advises careful identification, wide retroperitoneal exposure with direct ureteral visualization, fine instruments, and suture as a much more effective technique.

The occurrence of ureteral injury reported in the literature varies from 0.05%[11] to 30%,[13] depending on the material and types of procedures studied. Very high figures are noted with radical hysterectomy performed in the face of heavy radiation therapy. Those series with almost no ureteral injuries eliminated surgical procedures of any complexity. A more realistic figure for ureteral injury is that of Solomons et al, who obtained preoperative and postoperative intravenous pyelograms following routine gynecologic surgical procedures in 200 consecutive patients.[12] They found a postoperative ureteral injury rate of 2.5% and no fistulas were observed. Three injuries were associated with abdominal hysterectomy and two with vaginal hysterectomy. One patient had ureterolysis with relief of hydronephrosis; two patients' hydronephrosis resolved under observation; one was lost to follow-up; and hydronephrosis persisted untreated in the upper pole of one kidney drained by a duplicate ureter. Ureteral injuries are usually silent; if infection does not occur, the patient

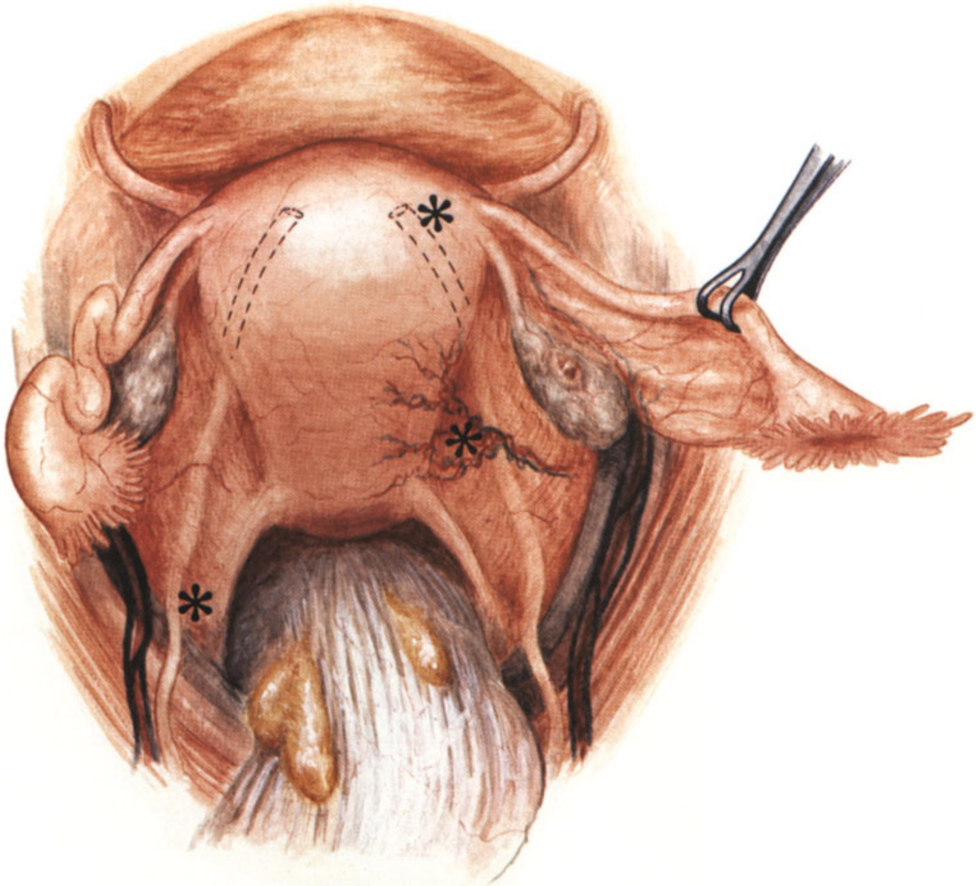


FIGURE 26-1. The pelvic surgeon must always be aware of the position of the ureter to avoid injuring it. Always visualize and palpate the ureter before dividing the ovarian vessels. Placement of large clamps blindly across these structures is a common cause of ureteral injury. Note the asterisk where the uterine arteries cross the ureter. Injury most commonly occurs at this site during abdominal hysterectomy. Avoid this injury by carefully visualizing and identifying the ureter as it lays laterally in the parametria prior to ligating the uterine artery. Equally important in avoiding injury is thorough dissection of the bladder downward and the use of Deaver retractors to keep the bladder out of the field during uterine artery ligation. Another site of injury is the terminal portion of the ureter as it courses over the upper third of the vagina. This area is commonly injured during vaginectomy and radical hysterectomy. Careful and repeated visual ureteral identification before division of the vagina minimizes ureteral trauma. Another type of injury is inclusion of the ureter in reperitonealization of the pelvic peritoneum. It is not worthwhile surgically to attempt to pull together torn and injured isolated segments of peritoneum at the risk of ureteral injury when the ureter cannot be identified. If pelvic peritoneum remains, close it with constant reference to the ureter.

will notice little, and silent renal unit loss will occur. None of Solomons' five patients had particularly alarming symptoms or physical findings.

If the ureteral injury is one of transection or of significant injury near the vault, ureterovaginal fistula may occur. If unrecognized, ureteral injury produces extravasation of urine into the peritoneal cavity, and signs of peritoneal irritation rapidly develop, i.e., a rigid abdomen, rapid pulse, and ileus. If extravasation is retroperitoneal and undrained, abscess formation usually occurs.

Repair of Injury

The ideal time for repair of ureteral injury is at the time it occurs, and the gynecologist will be the only surgeon in attendance in most instances. It is therefore necessary that the gynecologist know and understand the basic data on wound healing, operative techniques, and the outcome of such repairs. The detection of suspected ureteral injury is illustrated in Fig. 26-2.

Uroepithelium of the ureter has great regenerative powers and will seal its leaks in 48 hours in the absence of obstruction. Although the ureteral muscle seems to have little ability to regenerate, the submucosa has considerable inductive power over the surrounding mesenchymal cells. Intense fibrosis progressing to stricture formation and even osteogenesis with bone formation may occur and are promoted by urine. Fibrosis is diminished by diversion of the urinary stream during healing and does not occur if immediate nephrectomy follows ureteral injury.

The importance of the delicate periureteral vascular sheath and the ureteral bed of retroperitoneal fat in resumption of normal function cannot be overemphasized. Gentle and delicate handling of the ureter and these tissues is vital to the success of any reconstructive procedure. The reader is referred to the text by Peacock and Van Winkle for a more detailed discussion of this subject.[10]

Distal Ureter

If the ureter is crushed with a hemostat, the hemostat may simply be removed with no expected disability. Mannes et al crushed dog ureters with Kelly clamps approximately 5 cm from the entrance into the bladder for a period of 5 seconds to 60 minutes.[8] Intravenous pyelograms were taken at 1 week and at monthly intervals thereafter. No fistulas or urinary extravasation resulted, and serial intravenous pyelograms demonstrated progressive dilatation only after a 60-minute crush. Although some abnormality in peristalsis was noted, in general all renal units were preserved. Note that Mannes et al did not dissect the ureter out of its bed but rather crushed it in situ. John Masterson traumatized canine ureters by rubbing them with gauze, handling them with forceps, or ligating both hypogastric arteries; no fistulas were noted.[9] Some researchers feel that canine ureters have different healing qualities and that we should be somewhat reserved in our acceptance of such data. Higgins observed seven patients with ureteral clamping without urologic abnormalities and observed that temporary clamp application did not seem to be a factor in fistula formation in his series.[4] Should the ureter be included in a tie, the ligature may usually be removed without injury.

The importance of using nontraumatic instruments in pelvic surgery is again emphasized. If one crushes and devitalizes ureteral tissue, such as may occur with a Heaney-Ballentine clamp or other grossly injurious instruments, as opposed to a less traumatic clamp, then considerable clinical judgment must be employed as to the viability of such tissue. It may be necessary to pass a ureteral catheter through this area and leave it in place for 7 to 14 days.

If the ureter has been transected, then implantation is indicated (Figs. 26-3 and 26-4). The ureter is followed back to unquestionably normal and well-vascularized ureter. The bladder can be mobilized and fixed to the psoas muscle to avoid any tension. A simple mucosa-to-mucosa implantation into the bladder has produced far superior results as compared with ureteroureteral anastomosis. The Boari flap is rarely indicated as an initial procedure. However, in cases where undue ureteral tension results despite bladder mobilization, this procedure can increase the functional length of the bladder (Figs. 26-5

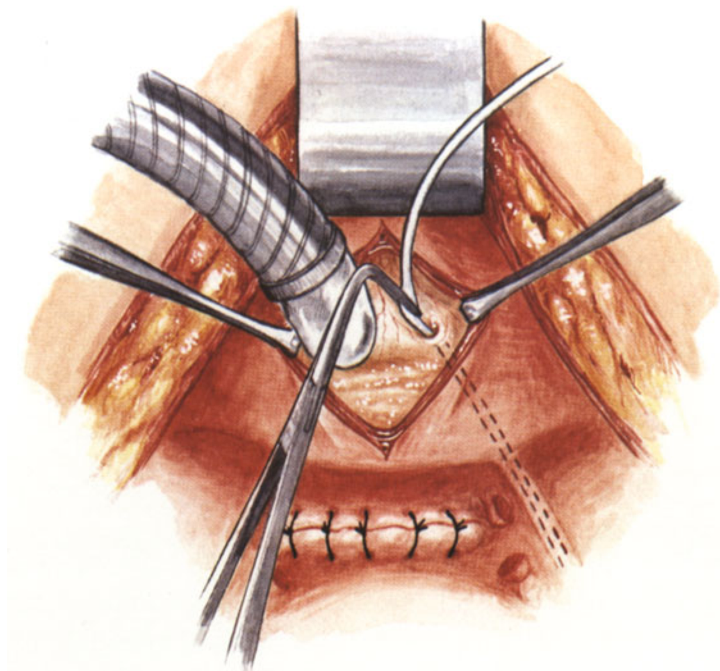


FIGURE 26-2. If ureteral injury is suspected, dissect the pelvic ureter in its entirety, beginning at the pelvic brim where positive identification is possible. An additional method of establishing its injury is to pass a polyethylene tube or No. 5 ureteral catheter in a retrograde fashion up the ureteral orifice in the trigone of the bladder. Grasp the dome of the bladder between Allis clamps and sharply enter the bladder. Enlarge the defect to produce adequate exposure of the trigone. Replace the Allis clamps to include full thickness of the bladder muscle and mucosa. Aspirate any urine present with a neurosuction tip and place a fiberoptic light source into the bladder. The ureteral orifices are usually located just lateral to the Foley catheter and are easily observed as small slits intermittently expelling urine. If the patient has had irradiation injury with bullous edema, visualization may be difficult. If the ureters cannot be easily located, inject 5 mL indigo carmine intravenously and observe its appearance in the bladder. Place 5 to 10 mL saline in the bladder with intermittent aspiration to make identification of the spurts of urine containing indigo carmine easier. Use care not to traumatize the mucosa as this will make placement of the ureteral catheter more difficult. After the ureters have been identified, grasp the polyethylene tubing or ureteral catheter with fine long right-angle forceps, enclosing the end of the catheter in the jaws of the instrument; place it through the ureteral orifice in the direction of the ureter. The tube is easily identified as it passes into the ureter and upward into the retroperitoneum. Any obstruction or division is easily identified. If the ureter has been divided, the passage of indigo carmine from any site will be observed as well. Retrograde passage of a catheter is useful if the surgeon is called in for consultation when the operator may have crushed large portions of tissue with mass ligatures during pelvic surgery.

through 26-8). Antireflux anastomosis, although crucial in children and theoretically superior, seems not to be necessary for satisfactory long-term results in adult females.[6,14] Because of the high incidence of stricture and peristaltic dysfunction with end-to-end anastomosis of the distal ureteral segment, implantation is the preferred procedure. Most of the pelvic surgical injuries can be handled by implantation, as the bladder can be mobilized to the pelvic brim and good results may be anticipated.

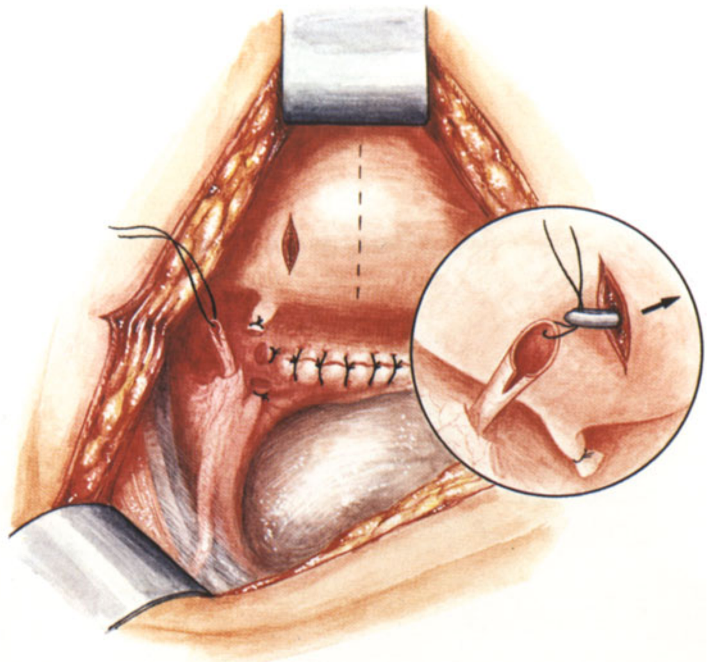


FIGURE 26-3. Significant injuries in the pelvic ureter are best managed by reimplanting the ureter into the bladder. This is done by mobilizing the bladder, dissecting the space of Retzius, and continuing the dissection laterally, freeing that margin of the bladder to be pulled upward. The obliterated hypogastric artery may be divided if it retards bladder mobilization. Suture the bladder well up on the iliopsoas muscle with several sutures of 2–0 absorbable suture. Make certain the ureter reaches and extends 1 to 2 cm beyond the bladder without tension. Use the incision made into the dome of the bladder to facilitate retrograde catheter passage for ureteral reimplantation site formation. Identify the proper site, which is generally in the most superior portion where the ureter reaches the bladder without tension. Place a right-angle clamp through the opening in the bladder to this site, open it, and produce a defect of 5 to 6 mm through all layers. Trim any ureter that does not appear entirely viable after the initial trimming and spatulate it with Potts right-angle scissors. Make every effort to preserve the periureteral vascular sheath and minimally handle the ureter by its peritoneal covering if any remains. Place a suture through the side opposite the spatulation incision and use it for a traction suture. Grasp this traction suture with right-angle forceps and pull the ureter into the bladder. Use four sutures of 4–0 absorbable. Place these through all layers of the ureter, bladder mucosa, and inner muscularis. Place one stay suture of 4–0 absorbable between the periureteral sheath and outer bladder muscularis and suture any remaining peritoneal covering against the bladder surface. There must be no tension on this anastomosis and the ureter should lie loosely against the bladder. Observe the blood supply of this anastomosis. If the blood supply is questionable redo the anastomosis. Close the bladder with two layers of 2–0 absorbable suture. Make certain the initial layer imbricates the mucosa. No bladder mucosa should be visible when the second layer is completed. No stent is required in the ureter for the anastomosis. Place a retroperitoneal suction drain and leave the Foley catheter in place for 1 week. The suction catheter should not be in contact with the anastomosis site. It may be removed in five days or, if the anastomosis leaks, leave it in place until urine drainage ceases. The presence of urine or serum in the suction catheter can be established with the injection of indigo carmine. Do not use wall suction; instead use Hemovac-type suction that uses low pressures.

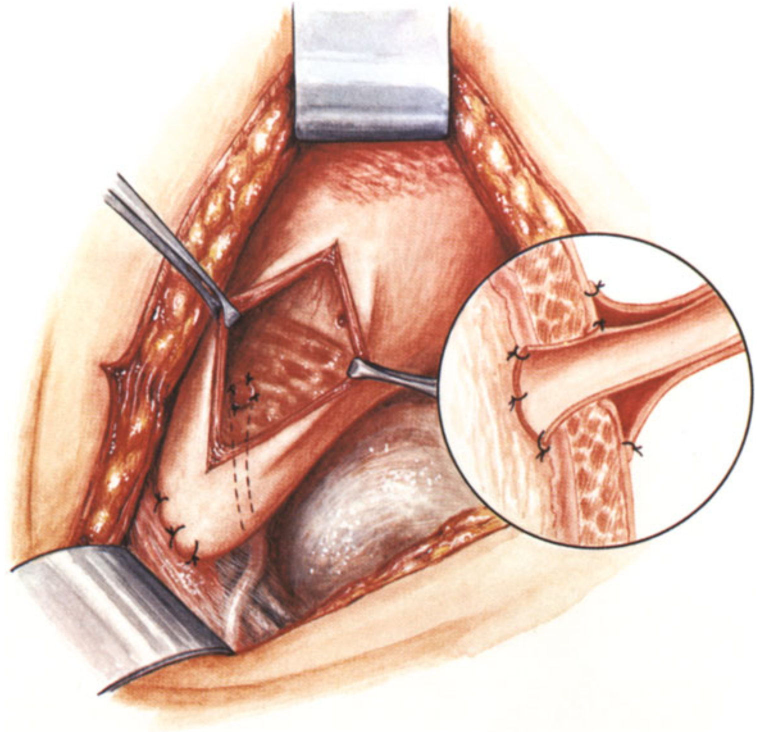


FIGURE 26-4. The anastomosis through the bladder wall is a straight, simple anastomosis without any tunnel formation. No antireflux procedure is necessary. If the surgeon provides an adequate blood supply, creates a tension-free anastomosis, and employs minimal suture material in a nontraumatic fashion, the results will be excellent. Expect some calyceal blunting and mild hydronephrosis in the initial intravenous pyelogram following ureteral reimplantation. This resolves in 2 to 3 months on follow-up study.

Middle Third

Injuries in the middle third of the ureter such as passage of suture through the ureter or incision require no therapy. Excision of a margin of the ureteral tube can be handled by simple suture repair. Experimentally, the ureter will heal defects of one half its circumference if not obstructed. If however, the ureter is transected in its upper middle third, then the area should be freshened and a spatula-type end-to-end anastomosis performed (Fig. 26-9). Weinberg has carefully studied this ureteral anastomosis and its reported poor results. His recommendations are incorporated in this technique, and his writings merit review.[15]

In all reconstructive procedures the presence of an adequate blood supply and the absence of tension are absolutely essential. If the ureter has been shortened, mobilizing the kidney downward is of benefit to relieve any tension at the site as well as mobilizing the bladder and suturing it to the psoas muscle. An extraperitoneal drain may be placed to drain the urine at this site. The drain should be in place for 10 days to allow a well-formed tract for drainage. Suction catheters, although preferable, must not be in contact with the anastomosis and may be sutured into position with fine chromic gut or other absorbable suture. From an experimental standpoint, it is better that the anastomosis not be splinted.[10]

A 2.5-cm ureterotomy 5 cm above the anastomosis to divert the urine will decrease the incidence of stricture. The drain leading to the ureterotomy site can be removed in 10 to 14 days. The incidence of problems following ureterotomy is minimal and stricture at the ureterotomy site is rare.

Upper third

Injuries of the upper third of the ureter are usually not associated with gynecologic procedures but are often a result of gunshot wounds or other major

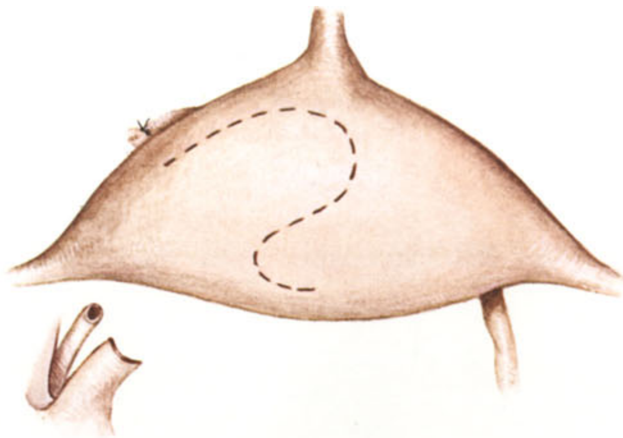


FIGURE 26-5

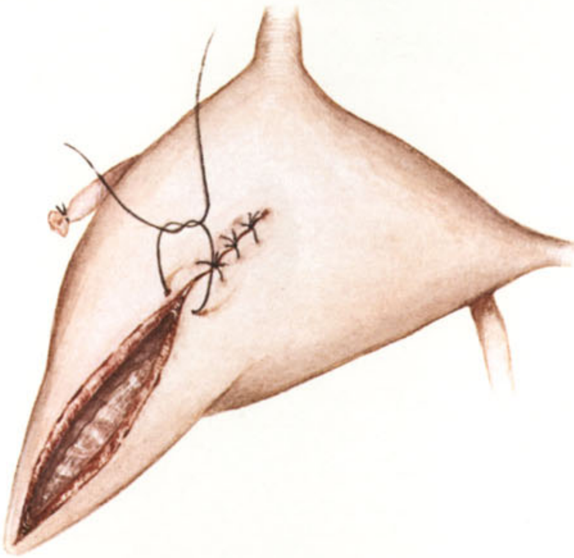


FIGURE 26-6

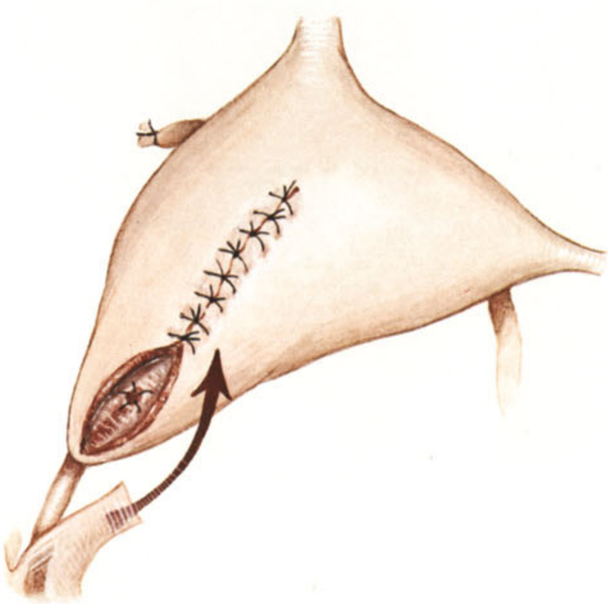


FIGURE 26-7

FIGURE 26-8

FIGURES 26-5 through 26-8. Modified Boari flap.[14] Create an anteriorly oblique bladder flap with a wide base to ensure adequate blood supply. Under direct visualization perform an end-to-side, mucosa-to-mucosa ureteroneocystotomy. Closure of the bladder flap with two layers of interrupted absorbable suture should result in a 5- to 8-cm bladder extension. If a peritoneal flap has been preserved, place it over the anterior cystotomy to provide additional relief of tension at the anastomosis site.

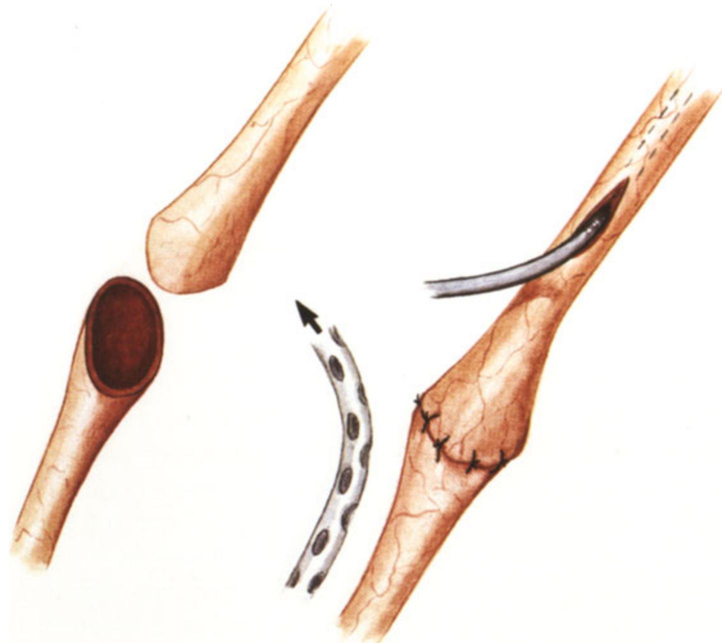


FIGURE 26-9. Freshen the transected upper middle third of the ureter by cutting the severed ends diagonally with Potts scissors. Spatulate when necessary. Touch the ureter as little as possible. Do not dissect the periureteral sheath. Close the ureter with 5–0 absorbable suture on a swaged needle through and through using a wedge-type suture incorporating more muscularis than mucosa. Four to five sutures will usually suffice. Inject indigo carmine at the onset of repair to make certain it is watertight. Make an incision in the ureter 4 cm above the anastomosis and pass a soft No. 5 catheter or infant feeding tube up the ureter to divert the urine flow. Pass this out a stab wound and suture it to the adjacent fascia with 4–0 absorbable. Place a suction catheter in the area and suture it in position such that it is not in contact with the ureter. Do not use wall suction. Remove the ureterotomy and drains in 10 to 14 days.

trauma. Ureteroureterostomy is the procedure of choice. Although these cases are not usually seen on a gynecologic service, should a long stricture occur as a result of radical hysterectomy or irradiation injury, a ureteroureterostomy may be performed as indicated or ileal diversion may be considered.

Postoperative Management

Careful follow-up of patients with ureteral injuries is very important. Ihse reported 39 reconstructive procedures for surgical injuries of the ureter.[5] The majority were located in the distal ureter and were repaired in 16 instances by ureteroneocystostomy. Three of these progressed to stricture formation: two were reimplanted, and one Boari flap was constructed. Ten end-to-end anastomoses were fashioned and five required reoperation: two were implanted into the bladder, and two were managed by nephrectomy and one by Boari flap. A wide variety of other reconstructive procedures were employed, and it is noted that although four patients died of associated malignant disease, there was no operative mortality. Of the 33 patients followed, 25 were symptom-free at follow-up examination for 0.5 to 10 years after surgery. Four patients had had urinary tract infections.

Even better results were noted by Beland.[1] He reported on the management of 34 ureteral injuries in 25 patients after gynecologic surgical procedures. Except for temporary urinary fistulas, the immediate postoperative course was benign. No kidneys were lost and no urologic reoperation was required.

The injury should be repaired when it occurs, before the process of fibrosis and stricture formation begins. Simple ligation of the proximal ureter with loss of the kidney is rarely indicated in modern gynecologic surgery.

Needle Nephrostomy

In certain patients surgical repair for ureteral obstruction and subsequent hydronephrosis is ill advised, given the patient's underlying disease process or medical condition. The traditional attempt to drain the hydronephrotic kidney with a large bore catheter increasingly is being replaced with needle nephrostomy under fluoroscopic or ultrasonographic guidance (Fig. 26-10).

Candidates for this procedure should be carefully selected. In reporting a series of percutaneous nephrostomies in oncology patients, Mann et al advised that their use be restricted to managing renal failure in untreated patients who cannot be stabilized medically and in previously treated patients with recurrent carcinoma who are candidates for aggressive chemotherapy.[7] Additionally, percutaneous nephrostomy may be useful in temporizing patients with benign disease whose medical condition precludes immediate operative intervention.

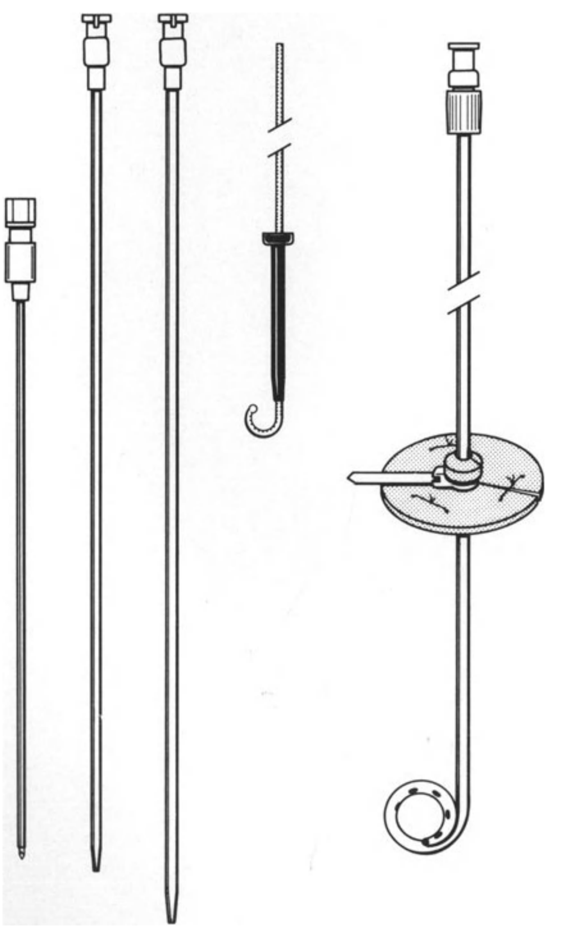


FIGURE 26-10. Percutaneous nephrostomy. Localize the renal pelvis with fluoroscopy or ultrasonography, and under local anesthesia insert a 19-gauge, 8-inch, thin-walled needle with an 18-gauge sheath. Remove the needle and stylet. Insert a moveable core guide wire through the sheath into the renal pelvis. Remove the sheath and replace successively with No. 5 and 8 French Teflon dilators, which are advanced over the guide wire until they are within the renal pelvis. Withdraw the No. 8 dilator and replace it with a No. 8 French catheter. Secure the catheter to the skin and bandage.

References

1. Beland G: Early treatment of ureteral injuries found after gynecological surgery. *J Urol* 1977; 118:25–27.
2. Conger K, Beecham CT, Horrax TM: Ureteral injury in pelvic surgery. *Obstet Gynecol* 1954; 3:343–357.
3. Eisenkop SM, Richman R, Platt LD, et al: Urinary tract injury during cesarean section. *Obstet Gynecol* 1983; 60:591–596.
4. Higgins CC: Ureteral injuries during surgery. *JAMA* 1967; 199:118–124.
5. Ihse I: Surgical injuries of the ureter. *Scand J Urol Nephrol* 1975; 9:39–44.
6. Lee RA, Symmonds RE: Ureterovaginal fistula. *Am J Obstet Gynecol* 1971; 109:1032–1035.
7. Mann WJ, Hatch KD, Taylor PT, et al: The role of percutaneous nephrostomy in gynecologic oncology. *Gynecol Oncol* 1983; 16:393–399.
8. Mannes H, Zimskind PD, Subbarao Y, et al: Crush injury of the lower ureter: An experimental study. *J Urol* 1972; 108:548–552.
9. Masterson JG: An experimental study of ureteral injuries in radical pelvic surgery. *Am J Obstet Gynecol* 1957; 73:359–370.
10. Peacock EE Jr, Van Winkle W Jr: Healing and repair of viscera, in *Wound Repair.* Philadelphia, Saunders, 1976, ch 12.
11. Rusche CF, Bacon SK: Injury of the ureter. *JAMA* 1940; 114:201–207.
12. Solomons E, Levin EJ, Bauman J, et al: A pyelographic study of ureteric injuries sustained during hysterectomy for benign conditions. *Surg Gynecol Obstet* 1960; 111:41–48.
13. St Martin EC, Trichel BE, Campbell JH, et al: Ureteral injuries in gynecologic surgery. *J Urol* 1953; 70:51–57.
14. Symmonds RE: Ureteral injuries associated with gynecologic surgery: Prevention and management. *Clin Obstet Gynecol* 1976; 19:623–644.
15. Weinberg SR: Injuries of the ureter, in Bergman H (ed): *The Ureter.* Harper & Row, New York, 1967.

Selected Bibliography

Peacock EE: *Wound Repair.* 3 ed Philadelphia, Saunders, 1984.

27 Gynecologic Surgery and the Aged

Charles V. Capen

"We must bear in mind that as we keep people alive longer we will be performing many more procedures for diseases associated with increasing age—more prostate operations, more cataract operations, more hip replacements, etc. We will be obliged to devote a greater proportion of our resources to restorative procedures for the elderly."[4]

The average life expectancy in the United States now approaches 75 years. Some estimates suggest that in less than 20 years there may be more than 6 million people in the United States who are over 85.[8] At the same time the elderly population is growing, all major causes of death are declining. The greatest decrease is in death from cardiovascular disease. This decline is somewhat unexplained in that it began before many of the recent advances in medical therapy. With an ever increasing geriatric population and better control over acute medical problems, the elderly are having more surgery. Ten years ago a 70-year-old woman with stress urinary incontinence and vaginal prolapse may not have been a candidate for surgery. Today this same woman has an average of 13 years left to live and still may well be sexually active.[16] Surgery is now an appropriate management strategy.

Many factors have contributed to the improved prognosis for geriatric surgery. Age in itself is not a contraindication. If acute and chronic diseases of the organ systems are carefully evaluated, monitored, and treated, morbidity and mortality may be reduced greatly. Unlike the younger patient, the geriatric woman frequently has as many as six chronic diseases, is on multiple medications, has marginal reserve in the major organ systems, and frequently has complicating social, financial, and psychological problems. Morbidity and mortality are increased substantially when urgent or emergency surgery is necessary, and complicating factors cannot be stabilized preoperatively.

With age all systems are less efficient; some more than others. Studies of various species, populations of the same species, organ systems, and cell cultures have helped to define some of these changes but precise etiologic factors remain unknown. On a cellular level, however, studies of morphology, function, enzymatic changes, cellular membrane functions, and ultra-structure contribute to the increased understanding of senescence.

The life span of most species is closely related to its reproductive function. Those species that produce large numbers of young in a short period have short life spans. Those that produce few young with a long gestational period have a relatively long life span. Death generally follows soon after reproductive ability ceases in most species other than *homo sapiens.* Subpopulations in these species may show variation from the average life span, suggesting a genetic determination of life span.

Cellular and Organ System Changes

At the cellular level there are a number of findings associated with the aging organism. It appears that both in vivo and in vitro cells have a limited reproductive span. This is determined by many factors, known and unknown, such as species, specialization of cell functions, genetic information, etc. At a structural level the cells show clumping, shrinkage, and fragmentation of chromatin. There are fragmentation of golgi and depletion of glycogen deposits as well. On a functional level there is deterioration in cell membrane function, a decline in enzymatic storage, and a decrease in efficiency of energy pathways and protein synthesis, with a predictable deterioration of cell function.

Various single factors have been hypothesized as being the major etiology of senescence. Most likely a variety of determinants are involved. A set reproductive life is a factor. There also appears to be a loss of the ability of cells to repair errors in DNA translation and transcription. The errors occur continually, and if the ability to repair them is diminished, the organ function will decline. Closely associated with this theory is the suggestion that damage from chronic low doses of environmental radiation are not repaired and may result in the compromise of cellular function. Immunosenescence has also been suggested as a major cause of aging. As structural changes occur in the biochemical makeup of cells, an autoimmune response may occur resulting in cellular dysfunction. Other hypotheses suggest that the underlying cause for aging may be secondary to generalized enzymatic or membrane deterioration.

Organ systems age at various rates, with those reaching mitostasis first showing the most obvious effects. In the absence of disease, the organism generally ages in a fairly uniform manner, but this rarely occurs. As cell function declines, the organ does likewise. The effect on the organism is not entirely obvious until the reserve organ capacity is eliminated and performance declines.

Surgical Considerations

The Cardiovascular System

Aging and disease frequently are inseparable. The frequency of many pathologic conditions in the elderly makes them the norm. Nowhere is this better illustrated than in the cardiovascular system. Atherosclerotic vascular disease, hypertension, valvular disease, and conduction defects are ubiquitous in the elderly. Cardiovascular disease is the most common cause of death in the elderly and is one of the two most important causes of death in surgical patients, the other being pulmonary disease. For practical purposes the cardiovascular system can be separated into the pump and the conduits. The myocardial cell's function is to contract. The deterioration at the cellular level which occurs with aging will result in a less efficient pump. The aged heart undergoes myocardial hypertrophy, a reduced capillary to muscle ratio, calcification of valves that may result in functional problems or conduction defects, and a reduced flow through the coronary arteries. On a functional level there is a decrease in maximal oxygen consumption that parallels the cardiac output, and the ejection fraction declines.[10] The right and left diastolic pressures increase with stress and are seen clinically with an increase in the pulmonary wedge pressure. In the peripheral vascular system there is fragmentation of elastic fibers, calcium deposits, cross-linking of collagen, and an increase in capillary basement membrane resulting in a decline in the ability to deliver nutrients and oxygen to the cell.

Illness, anesthesia, and surgery further complicate the clinical picture. Malnutrition, bowel preparation, extensive diagnostic procedures, medications, and electrolyte problems may lead to additional difficulty. Intravascular depletion may result from dehydration, third-spacing due to illness or surgery, hemorrhage, hypoalbuminemia, or the use of diuretics. A decline in cardiac output in a system that has little reserve is often the case. The effects of anesthetic drugs which are depressants may be seen, as well as the effects of acidosis, hypoxia, shunting, and fluid overload. Hypothermia also may result in a marked increase in oxygen consumption. Postoperatively, the patient is stressed by volume changes, pain, surgical trauma, tachycardia, possible sepsis, and compromise to other organs such as the lungs or kidneys. For this reason, careful preoperative evaluation, intraoperative monitoring, and postoperative support are crucial.

The American Society of Anesthesiologists Physical Status Scale is the most common prognostic category used for patients with cardiac disease (see Chapter 5). It incorporates other illnesses and has been shown in multiple studies to be fairly accurate in predicting the risk of anesthesia. A second prognostic category is Goldman's Cardiac Risk Index[6] (Table 27-1). This is more specific and also has a good predictive value. Neither prognosticator, however, takes into account the magnitude of the surgical insult nor the acute complications which occur. They both appear to do well predicting which patients with cardiac disease may do poorly, but they do not predict which patients without diagnosed disease will develop cardiac disease pre- or postoperatively.[7]

Several specific clinical conditions require attention. Atherosclerotic heart disease with cardiac ischemia and infarction are frequent findings in the elderly. Unstable angina is a definite risk factor that prohibits elective surgery. Preoperative angiography and possible coronary artery bypass should be considered before any but the most urgent surgery. Stable angina is less of a problem. Myocardial infarction in the postoperative period, particularly in the elderly, is likely to present in an atypical manner such as rhythm hypoxia, a change in vital signs, or atypical pain. Fully 50% of infarctions in the operative period are silent. Patients who have had previous coronary artery bypass surgery appear to have a risk factor similar to those with other heart disease.

Cardiac patients with evidence of uncompensated failure should not undergo surgery until they are stabilized with diuretics and digitalis. Digitalis levels frequently are abnormal in the elderly because of slow absorption, decreased deposit in skeletal muscle mass, poor renal function, and erratic dosing. Hypokalemia which increases the risk of digitalis toxicity also is frequent in elderly patients with chronic diseases. If there is doubt as to coronary function, preoperative ejection fractions may be useful.

A third major group of cardiac patients are those with dysrhythmias and conduction defects. Premature ventricular beats that are multifocal, appearing in salvos, or during a T-wave are particularly dangerous and require prompt treatment. Atrial fibrillation, flutter, or paroxysmal atrial tachycardia may reduce cardiac output and should therefore be treated. Conduction defects generally have been overemphasized. A right bundle branch block may progress to a complete heart block and pacing may be required, although in 44 elderly patients with right bundle branch block during 53 operative procedures,

Table 27-1. Goldman's Cardiac Risk Index

Criteria*	Multivariate Discriminant-Function Coefficient	"Points"
1 History:		
(a) Age > 70 yr	0.191	5
(b) MI in previous 6 mo	0.384	10
2 Physical examination:		
(a) S_3 gallop of JVD	0.451	11
(b) Important VAS	0.119	3
3 Electrocardiogram:		
(a) Rhythm other than sinus or PAC's on last preoperative ECG	0.283	7
(b) >5 PVC's/min documented at any time before operation	0.278	7
4 General status:		
PO_2 <60 or PCO_2 >50 mm Hg, K <3.0 or HCO_3 <20 mcq/liter, BUN >50 or Cr >3.0 mg/dl, abnormal SGOT, signs of chronic liver disease or patient bedridden from noncardiac causes	0.132	3
5 Operation:		
(a) Intraperitoneal, intrathoracic or aortic operation	0.123	3
(b) Emergency operation	0.167	4
Total possible		53 points

* MI denotes myocardial infarction; JVD, jugular-vein distention; VAS, valvular aortic stenosis; PAC, premature atrial contractions; PVC, premature ventricular contractions, PO_2, partial pressure of oxygen; PCO_2, partial pressure of carbon dioxide; K, potassium; HCO_3, bicarbonate; Cr, creatinine. (From Goldman.[6]) Reprinted by permission of the New England Journal of Medicine, 297:845–850, 1977.

only one developed a temporary block.[12] Left bundle branch blocks are significant as an indicator of cardiac disease but otherwise rarely are a problem.

Valvular changes occur with age. There is progressive calcification and mucoid degeneration. This is most prominent in the left heart and appears to be related to pressure. The calcification of the aortic valve is rarely significant except for accentuation of a systolic murmur. The more significant functional lesion is calcification of the mitral valve with resulting mitral insufficiency.[1]

Fifty percent of the elderly have some degree of hypertension. There are two primary risks associated with hypertension: uncontrolled hypertension may be labile and with the stimulation of anesthesia, pain, and surgery may result in stroke, and an already compromised heart is unable to pump effectively against a high pressure system. The operative risk for patients with hypertension is not actualized unless the diastolic pressure is elevated to 100 to 110 mm Hg. If the patient is this poorly controlled, surgery should be delayed. In an emergency, Nitroprusside is quite effective when carefully monitored.

Pulmonary

Pulmonary complications are secondary only to cardiovascular disease as a cause of operative mortality. The geriatric patient undergoing thoracic or abdominal surgery is at an increased risk for pulmonary complications because of preexisting disease and the pulmonary changes that occur with age such as alveolar septal membrane breakdown, loss of elasticity, decreased pulmonary reserve, a 45% diminution of vital capacity, a decrease in maximum breathing capacity and functional residual capacity, and a decrease in PaO_2.[13] By age 75, there is a 50% drop in maximum inspiratory and expiratory pressures and a 60% decline in maximum voluntary ventilation. The changes are compounded by the decrease in lung capacity, functional residual capacity, residual volume, and compliance, which typically occur postoperatively.[11] These changes usually are maximal by 48 to 72 hours, but with prior disease or other complications may continue to progress. Multiple factors such as splinting secondary to pain, narcotics, a supine position, and a depressed cough contribute to pulmonary complications. Obesity, a common problem in the elderly, also has been shown to reduce the functional residual capacity and the expiratory reserve volume.

Screening for pulmonary risk factors has been fairly accurate in predicting morbidity. Stein demonstrated in 33 patients with normal screening functions only one pulmonary complication. He found 21 complications in 30 patients with abnormal functions.[17]

Although all patients should have preoperative instruction on pulmonary therapy, the elderly and those with increased risk factors and/or abnormal screening tests should receive particularly intense teaching and postoperative measures. This has been shown to markedly decrease postoperative morbidity and mortality. The postoperative care may involve the use of bronchodilators, airway hydration, antibiotics, postural drainage, percussion, and occasionally steroids. Blow bottles, insensitive spirometry, and intermittent positive pressure are all effective in the expansion of atelectic alveolae. The most important factors are intensive nursing care, regular and intense coughing and deep breathing, early ambulation, and analgesia to control splinting. If respiratory function is borderline, mechanical respirators should be used. The elderly have little reserve to tolerate hypoxia, and a controlled situation is much safer.

Oxygen transport is frequently the unrecognized segment of the respiratory system. Tissue hypoxia is common postoperatively in the elderly, and hypovolemia and hypoperfusion appear to be major causes.[3] Other factors contribute to a decline in the transportation of oxygen. The aged frequently have decreased cardiac output or chronic anemia, and 2–3-Diphosphoglycerate also is decreased and may interfere with red cell function.[14] The careful monitoring and treatment of cardiac malfunction and anemia usually will control these complications. Blood loss should be replaced before hemodynamic changes or hypoperfusion occurs.

Urinary/Renal

The aging kidneys may have a major impact on the surgical geriatric patient. All kidney functions decline with age, including the abilities to clear urea or creatinine, to clear free water or maximally concentrate the urine, and to conserve sodium or excrete an acid load.[18] This decline in function most likely is related to the documented decrease in kidney size, in particular the diminished cortex, an increase in connective tissue, a decline in glomeruli, and a drop in the renal blood flow. Fortunately, in the nondiseased kidney there usually is adequate reserve to handle the normal demands of surgery. However, the elderly patient is more inclined to become hyponatremic and fluid overloaded following a major surgical stress. Appropriate monitoring to manage fluid status and cardiovascular function generally corrects output difficulties. The fractional excretion of sodium $\frac{\text{u/p Na}}{\text{u/p Cr}} \times 100$ is helpful in determining if oliguria is prerenal or renal. If < 1, it is prerenal, if > 1, it is renal. Diuretics are not indicated for oliguria in the postoperative period until appropriate measures have been taken to ensure an adequate renal blood flow. It is advised that blood and albumin be replaced rather than using large volumes of crystalloid, most of which is placed in the extracellular space. Aged kidneys may not have the ability to clear the excess water load as it is mobilized. If renal failure becomes obvious, dialysis should be begun immediately.

Nutritional Status

Although malnutrition is common in the aged, obesity frequently is more prevalent. In 130 geriatric gynecology cancer patients at the University of Kansas, 50% were obese. The surgical risks of obesity are not major until a person becomes grossly overweight. Then there is a decrease in pulmonary functions and an increase in the need for respiratory support postoperatively. An increase in wound complications such as infection, dehiscence, and hernia formation also is found.

Nutrition is a major health problem in the elderly. Poor nutrition may be secondary to multiple chronic illnesses, social problems, a decline in the ability to taste, mobilization difficulties, or dental problems. Certainly, poor nutrition influences the body's ability to fight infection, heal wounds, mobilize, and handle respiratory needs. Despite these needs, it is rare for a wound not to heal because of poor nutrition. For elderly patients it is important for the clinician to get a careful nutritional data base that includes measurements of visceral and somatic protein. If moderate or severe deficiencies are found, pre- and postoperative nutritional support is necessary, whether this takes the form of parenteral, enteral, or supplemental feedings.[2]

Immune System

The immune system also ages, placing the geriatric patient at an increased risk of hospital-acquired infections. Although the number of B-cells does not decline and the level of immunoglobulins is normal, there is a decrease in antibody response. This may be a result of the B-cells' diminished function. More apparent is a decline in cell-mediated immunity. This may indirectly lead to death secondary to infection from normal flora. Fever also is less likely in an infected geriatric patient.[5] These changes in the ability to tolerate infection frequently are associated with other factors such as poor nutrition, chronic illness, and cancer, which have been shown to cause anergy.[19] Moreover, older persons have a depressed T-cell response postoperatively and have therefore less immunologic resilience to a surgical stress than younger patients.[9]

Technological Advances

Perhaps the single most important advance in the management of the surgical geriatric patient has been improvements in intra- and postoperative monitoring. As all aged organ systems have little or no reserve, the effects of stress, hypoxia, hypotension or hypertension, and fluid overload or depletion are critical. Until the mid-1970s the technology needed to carefully monitor these changes was not readily available.

The almost routine use of direct arterial catheterization allows for an instantaneous measurement of peripheral perfusion, as well as furnishing an access for the quick and accurate measurement of arterial gases and electrolytes. This technique has been shown to have a low-risk, high-benefit ratio in 1,699

Table 27-2. Obtainable Information Through a Pulmonary Artery Catheter

Central venous pressure
Pulmonary artery pressure
Pulmonary capillary wedge (PCW) reflecting left atrial pressure (LAP)
LAP reflecting left ventricular end-diastolic pressure (LVEDP)
Cardiac output (CO)
$\frac{CO}{HR}$ = Stroke volume (SV)
SV (mean arterial pressure − PCW) reflects left ventricular stroke work (LVSW)
Systemic vascular resistance
Pulmonary vascular resistance
Degree of intrapulmonary shunt

Reproduced with permission from Capen CV and Capen JB[2]: Aging and Disease in the Geriatric Gynecology Patient, in Leventhal, J.M., et al. (eds.): Current Problems in Obstetrics and Gynecology. © 1983 by Year Book Medical Publishers, Inc., Chicago."

patients studied and should be used readily in the geriatric patient undergoing major surgery or in the presence of cardiovascular or pulmonary disease.[15]

The second major advance in monitoring has been the use of pulmonary artery catheters. The placement of these catheters allows the collection of information that would not otherwise be available (Table 27-2).

As a result of the catheter, the physiologic process that is complicating the clinical situation generally can be diagnosed and treated. This information is particularly valuable in the elderly patient who has multisystem disease or compromise. The use of this catheter allows finer adjustment of preload pressures and cardiac output. It also allows for calculation of intrapulmonary shunting, which may be extremely valuable.

The third factor that has aided in the support of the critically ill elderly patient has been the development of new drugs that support the cardiovascular system under more controlled conditions.

Summary

If the physiologic changes of aging are clearly understood and utilized in the management of the geriatric surgical patient, and the newer advances in surgical support are appropriately applied, the older patient may undergo indicated surgery without excessive risk. A smooth, uncomplicated preoperative, intraoperative, and postoperative course can be expected.

References

1. Bloon CM: The science base; valvular heart disease in the elderly. *J Am Ger Soc* 1982; 30:466–472.
2. Capen C, Capen J: Aging and disease in the geriatric gynecology patient. *Curr Probl Obstet Gynecol* 1983; 6:4–44.
3. Chang N, Goodson WH, Gottrup F, et al: Direct measurement of wound and tissue oxygen tension in post-operative patients. *Ann Surg* 1983; 197:470–478.
4. Feinleib M, Haynes SG, Feinleib ME: Proceedings of the second conference on the epidemiology of aging. NIH Pub:80–969, Washington, DC, US Government Printing Office, 1980, p 359.
5. Finkelstein MS: Unusual features of infection in the aging. *Geriatrics* 1982; 37:65–78.

6. Goldman L, Caldera DL, Nussbaum SR, et al: Multifactorial index of cardiac risk in non-cardiac surgical procedures. *N Engl J Med* 1977; 297:845–850.
7. Jeffrey CC, Kunsman J, Cullen DJ, et al: A prospective evaluation of cardiac risk index. *Anesthesiology* 1983; 58:462–464.
8. Kovar MG: The elderly population: Use of medical care services by men and women in the middle and late years. Presented at the 108th Annual Meeting of the American Public Health Association, Detroit, October 1980.
9. Linn BS, Jensen J: Age and immune response to a surgical stress. *Arch Surg* 1983; 118:405–409.
10. Luchi RJ, Snow E, Luchi JM, et al: Left ventricular function in hospitalized geriatric patients. *J Am Ger Soc* 1982; 30:700–705.
11. Nunn JH: Anesthesia and the lung. *Anesthesiology* 1980; 52:107–108.
12. Pastore JO, Yurchak PM, Janisk M, et al: The risk of advanced heart block in surgical patients with right bundle branch block and left axis deviation. *Circulation* 1978; 57:577–680.
13. Pump KK: The aged lung. *Chest* 1971; 60:571–577.
14. Rodgers GP, Litchman HC, Sheff MF: Red blood cell glucose-6-phosphate dehydrogenase activity in aged humans. *J Am Ger Soc* 1983; 31:8–11.
15. Slogoff S, Keats AS, Arlung C: On the safety of radial artery cannulation. *Anesthesiology* 1983; 59:42–47.
16. Statistical abstract of the United States 1983–84: National Data Book and Guide to Source, 104th Ed, US Department of Commerce, Bureau of the Census, 1983, p 73.
17. Stein M: Pulmonary evaluation of surgical patients. JAMA 1962; 181:765–770.
18. Tinnetti ME: Effects of stress on renal function in the elderly. *J Am Ger Soc* 1983; 31:174–181.
19. Weksler ME: The science base-age: Associated changes in the immune response. *J Am Ger Soc* 1982; 30:718–723.

28 Psychosocial Aspects of Gynecologic Surgery

Katrine Kirn

For any patient the prospect of surgery, whether major or minor, can be a highly stressful experience. Women facing pelvic surgery have added stress because of the relationship between the pelvic organs, sexuality, and reproduction. Also, women are frequently embarrassed by discussions about or examination of their pelvic organs. In some respects, a woman is intimately familiar with her reproductive organs. And yet, these organs are internal, poorly visualized, and sometimes understood more by fantasy than fact. Thus, gynecologic surgery is likely to produce a variety of emotional reactions. Good preoperative preparation and aggressive handling of these emotional reactions can result in better recovery and in patients who react more positively to their surgery, both physically and emotionally. Good preoperative preparation can significantly reduce negative emotional sequelae. Although this chapter focuses on several major procedures, the techniques and suggestions for avoiding pathologic postoperative reactions apply to all gynecologic surgical procedures.

Sexuality and Gender Identification

The concept of gender identification is central to understanding the psychological impact of gynecologic surgery. From the moment of birth, the process of gender identification begins. This concept is shaped by parental role expectations and reinforced by the environment. The gender identity continues to evolve based on the individual's gender role experiences and on her awareness of physical attributes.[15]

Differences in gender identity development between boys and girls are partially related to the differences in external sexual characteristics. The boy can see his genitals and has some sense of a relationship between appearance and function. He compares himself to other boys. He is able to see repeatedly the integration of appearance and function (which is not exclusively reproductive). A young girl must be told about her reproductive organs, which are "hidden away." She cannot see or touch her uterus; external genitalia are not easily visualized. Furthermore, female external genitalia and internal reproductive organs have many parts with different names and functions. Whereas a boy may have slang terms for his penis and testes, a girl has few or none for her counterparts. Thus, a girl hears of her uterus, primarily as the unseen "place where babies grow."[15] Consequently, her biologic role as a girl and woman becomes tied to the function of the uterus and to the role as mother. The appearance and sexual function of genitalia are given little if any emphasis during development. Thus a girl frequently reaches womanhood with an unclear sense of the function and structure of her reproductive organs. This ignorance and confusion can make any malfunction of or surgery on organs of reproduction a potentially devastating emotional experience. Since the organs of reproduction are central to gender identity, and gender identity is central to total individual identity, any removal of or surgery on these organs can produce major changes in self-image.

Hysterectomy—Special Considerations

The issue of gender identification and womanhood becomes most pertinent when the surgery being considered is hysterectomy. The controversy surrounding the emotional importance of the uterus has raged for the past century. Freud saw the uterus as a central symbol of femininity. He reported studies of women who had been institutionalized for severe emotional disorders and who had also undergone a hysterectomy.[8] At the other end of the spectrum, the uterus has been blamed for intractable hysteria and other emotional ills for which hysterectomy was seen as a cure. More recently the uterus has been defined as solely a reproductive organ. Thus, after the last planned pregnancy, the uterus is useless, potentially cancerous, and should be removed.[4] Despite better surgical technique, a reduction in surgical mortality, and more knowledge of physiology, endocrinology, and human sexual response, the utility of the uterus appears to be more controversial than ever.[15]

Although studies of emotional aftermath of hysterectomy are not always consistent in their conclusions, results do indicate that a woman's self-concept can be disrupted by the surgery. However, as one would expect, women differ in their attitudes toward their uterus and thus in their response to hysterectomy. There is no evidence that psychiatric disorders routinely follow a hysterectomy.[12] However, several variables appear to account for the varied emotional reactions of women.

All women have some reaction to the cessation of menstruation if hysterectomy occurs before menopause. Even in the presence of pathology and abnormal menses, menstrual periods have set a certain calendar or physiologic rhythm to a woman's life. Although often inconvenient and perhaps uncomfortable, women also view their menstrual periods as a "cleansing" and as a sign of health and normalcy. Thus, the sudden loss of this rhythm might appropriately be accompanied by some degree of mourning.

In women for whom childbearing is still an issue, the need to mourn the lost pregnancies is clear. Some individuals who planned no further pregnancies may still react with a sense of having lost the ability to bear children. How closely a woman's gender identity is tied to her childbearing potential and how closely sexual pleasure is tied to fantasies of possible procreation will determine much of her reaction.

Socioeconomic factors have been shown to be of major importance. Middle class women are more likely to request or agree to hysterectomy for purposes of contraception and to experience a sense of relief from pathology. Women in lower socioeconomic classes are more likely to link the uterus to well-being and sexual health, and are therefore more likely to experience greater concern about surgery's effect on the marital relationship.[15] Beliefs about the importance of the uterus in sexual relationships are common to all socioeconomic groups. Therefore, any patient and her sexual partner may require reassurance about her femininity.

Several factors are frequently cited as potential indicators for negative emotional sequelae following hysterectomy. General psychological factors include previous adverse reactions to stress, history of depression in stressful situations, positive family history for depression, marital dissatisfaction, and lack of vocational or avocational involvement. Positive medical factors include a history of multiple physical complaints and numerous hospitalizations and surgeries. Other risk factors include age at surgery (less than 35), desire for a child or more children, belief that the surgery will reduce libido and sexual satisfaction, and negative attitudes about hysterectomy from the partner or a significant other. Studies indicate that patients having several of these factors are at risk for serious emotional consequences 3 months to 1 year postoperatively.[15]

The most critical factor in psychological recovery after a hysterectomy is the reaction of the patient's husband or significant other. No matter what other positive factors exist in a woman's life, if her partner appears distant or emotionally or sexually disinterested, she is likely to become depressed. Partners who are emotionally supportive and understanding, who continue to find her attractive, and who experience intercourse as enjoyable contribute significantly to positive psychological adjustment. But even in the best of situations, women will experience some kind of uneasiness with the loss of an organ central to their gender identity.

Gynecologic Cancers

The diagnosis of cancer in a reproductive organ is likely to produce a wide range of emotional reactions. This is particularly common with gynecologic cancers because of the importance of reproductive organs to gender identity and because of the feelings and fantasies associated with these organs.

Adjustment to hysterectomy may be less difficult when performed as treatment for cancer of the uterus, cervix, or ovaries since the valued body part is diseased and undesirable. However, the patient is also called on to cope with the possibility of death and debilitation. Any patient with cancer experiences denial and anger. It is common to wonder whether past events might have "caused" the cancer. For a woman with cancer of the reproductive system, there may emerge guilt about previous sexual behaviors or feelings and beliefs that she is being punished for past behavior. The patient may project blame onto others such as her husband, feeling the cancer may have been stimulated through intercourse. Although the main issue is survival, a repressed anger about being born female may emerge. Despite the emotional load of gynecologic cancer, there has been little research on the emotional and social adjustment of these patients. An extensive study of 60 patients with cervical, uterine, and ovarian malignancies conducted at the Yale and New Haven Hospital[3] was able to shed some light on this area. Cain and her colleagues learned that all patients experienced at least mild depression. The higher the grade of tumor the greater the patients' depression and psychological impairment. Although patients reported that marital relationships continued to be satisfactory, sexual intimacy changed radically. Of the 60 women, 29 described a regular and satisfying relationship before the diagnosis of cancer. After the diagnosis, all 29 reported they no longer had intercourse. Whereas some had been told to abstain following surgery, others chose to abstain because they believed that intercourse would exacerbate vaginal bleeding or discharge. Overall, the diagnosis of gynecologic cancer seriously disrupted role function.

When radical surgery is required to treat gynecologic cancer, there is an even greater disruption in normal role functioning. In cases of total pelvic exenteration, one must expect a significant degree of depression. The surgery is extremely destructive, leaving the patient to make a major adjustment in body image. The patient must be able to separate her feelings of identity and self-worth from body image and sexual functioning. This is extremely difficult, since sexuality is such a significant part of identity. Major unresolved psychosexual conflicts leading to termination of any kind of sexual contact or termination of relationships have been found in the majority of patients following total pelvic exenteration.[7] As with hysterectomy, the patient's spouse or partner plays the crucial role in psychological recovery following surgery.

Little data are available on psychosexual adjustment for any kind of gynecologic oncology patient,[1] despite patients' eagerness to be interviewed and discuss their reactions to their illness and treatment.[7,16] These patients are unique in that they face a life threat as well as major changes in body image, sexuality, and role functioning simultaneously. It is imperative for physicians and their staff to provide these patients with as much information as possible regarding treatment, postoperative reactions, complications, and sexual functioning, along with alternatives for sexual functioning when necessary.

Infertility Surgery

Surgical procedures involved in the diagnosis and treatment of infertility range from something as simple as an endometrial biopsy done in the office to a hospital stay of several days for tuboplasty surgery. While the surgeon classifies what is minor and major, the patient often uses a different system of classification. The physician must always keep in mind the purpose of the procedure when considering how it will affect a patient emotionally.

Surgery of the Fallopian Tubes

For many patients tuboplasty is their last effort to become pregnant. They approach the surgery with great anxiety, wondering alternately if the procedure is worth the inconvenience and expense and if they would regret not having had the surgery in the future. The continuing fear of whether this will finally result in pregnancy, after what usually has been a long period of diagnostic and other treatment attempts, tends to increase patient anxiety. Ambivalence must be dealt with by a frank discussion of the chances for a successful outcome and of the length of the postoperative recovery period. Even after patients have made the decision to have surgery, ambivalence will persist through the preoperative and postoperative periods. High anxiety about postoperative chances for pregnancy should be expected, with increasing depression as each month passes without conception. Thus a realistic time span for conception should be presented to the patient. Patients should be prepared for anxieties and fears they may experience. This will serve the patient far better than being vague or overly optimistic.

Ectopic Pregnancy

In the case of ectopic pregnancy, patients must be advised about the effects on fertility and the increased risk of future ectopic pregnancies.[13] Beyond this, one must deal with the patient's emotions about a lost pregnancy and about lost fertility if this is a result. For some, feelings about the lost pregnancy may be overridden by feelings of relief that the patient has recovered.[11] In patients for whom mourning over lost pregnancy and fertility is severe, referral to an appropriate counseling source would be wise.

Voluntary Sterilization

Many women reach a point when they feel it is desirable or necessary to end their childbearing years. Tubal division presents itself to these women as a form of simple and effective contraception. While medical personnel should be cautious about asserting their own beliefs or opinions, it can be helpful for the physician to understand the emotions surrounding sterilization.

Women who voluntarily request tubal division have few, if any, negative emotional sequelae.[17] However, a major study delineated situations where negative reactions may develop.[10] Of 139 women (mean age 33.5, range 22–46 years; mean gravidity 5.0; mean parity 3.8), most expressed "having enough children" as their reason for requesting surgery. Most reported that they would like to have had the surgery earlier. Those patients who later reported that they were dissatisfied with their decision were more likely to have cited socioeconomic reasons for their decision than those in the satisfied group. Dissatisfied patients were also less likely to report that their partner was happy with their decision and more likely to feel that they did not receive adequate preoperative information. They expressed concerns of altered self-image and fears about health of existing children.

The dissatisfied patients showed a higher incidence of minor menstrual disorders, worsening of mood, and decrease in sexual satisfaction or no sexual activity postoperatively. Most women and their partners are satisfied with the results of tubal ligation and report no change or even a positive effect on physical and mental health and sexual activity. Patients with negative reactions are most often those who feel they must limit family size for socioeconomic reasons. These concerns should be carefully explored and temporary contraception considered when the patient feels she might change her mind if circumstances were to change. Although people frequently say "we can't afford to have any more children," the physician should explore whether this is really the only reason the patient is requesting voluntary sterilization. It is also wise to explore the decision for sterilization with partners as poor communication with partners is frequently cited by women who regret their surgery.[2,10]

Women in whom sterilization is suggested for medical reasons frequently develop anger, depression, and guilt[2] and should be given extensive information about reasons for the procedure and their options.

Although the physician should not set arbitrary limits for sterilization, the patient should be provided with adequate information and helped to consider future situations that might affect her decision. She should always be advised that tubal separation is nonreversible. The final choice must belong to the patient. The patient with the best chance for satisfaction and no negative emotional reaction will be one who made the decision freely, based on adequate family size alone.[2,10]

Preparation for Surgery and Recovery

In preparing a patient psychologically for surgery, no factor is more crucial than providing information. This is especially true in gynecologic surgery because of the emotionally laden nature of a woman's relationship with her reproductive system. One must not assume that the patient is emotionally or intellectually able to assimilate such information. It is the physician's responsibility to present the data in a way that each patient can understand. Reading reports that the primary purpose of psychological preparation is to improve the patient's psychological adjustment.[14] Well-prepared patients require fewer analgesics postoperatively and have shorter hospital stays.[5,6,14] Identifying and rectifying fantasies and myths related to the impending surgery may serve to prevent negative emotional responses later. Patients consistently indicate that they prefer being told about their surgery, and prepared patients expressed more confidence in nurses and less postoperative anger.[14]

Patients should be provided with comprehensive information about their surgery. All aspects of the surgical procedure, anesthesia, and preoperative and postoperative care should be discussed. Although the nursing staff can and should be utilized to explain pre- and postoperative care, it is essential that information regarding surgery also come from the physician. Studies of communication effectiveness indicate that a higher recall of information results when information is given by a high-status person.[9] Thus, patients should be more likely to remember surgical information given by their surgeon. Furthermore, categorizing information can also facilitate remembering[18] so it is helpful to structure and organize information rather than provide it in a haphazard manner.

Because gynecologic surgery raises many concerns about sexuality, discussions of postoperative sexual functioning should be initiated. It is best to begin these discussions rather than wait for the patient to ask questions and ignore the subject if no questions are asked. In addition to orders on how long to abstain from intercourse following surgery, patients should be advised as to how their surgery will affect sexual functioning and responsiveness. In cases of radical surgery, sexual functioning may be markedly changed, and patients must be carefully prepared for what to expect and advised as to alternative methods of sexual relations. Even minor surgeries, which should have no conceivable effect on sexual desire or function, have the potential for resulting in serious sexual dysfunction. Sexual partners should also be provided with information about postoperative sexual functioning. This is essential with radical surgery, but even in cases of tubal ligation, hysterectomy, or very minor surgical procedures, serious disruption of sexual functioning can and sometimes does occur.

Pathologic Reactions

Pathologic reactions to surgery normally do not occur in women who are mature and well adjusted. However, such negative reactions are possible, so one must be prepared for warning signs and symptoms. Individuals with an extremely high level of anxiety preoperatively or those who show no anxiety at all are at risk for poor postoperative recovery. Patients who appear to behave and cope with postoperative care in a style very different from their preoperative manner should also be considered at risk.

Hysterectomy is the surgery that has been most closely scrutinized for psychopathologic reactions. Research presents very mixed results as to how many posthysterectomy patients actually experience some serious psychological disruption. But there is agreement that if a serious reaction occurs, it is most likely to be depression.

All patients experience some type of mourning following surgery. They may be grieving over the loss of a valued body part, or over a lost sense of good health and invulnerability to illness. Generally, the initial mourning period lasts about 6 to 8 weeks and should be resolved within 6 months. This period may be extended in cases of malignancy, where the patient is coping with further treatment and issues of life and death. During the grieving period, patients will exhibit periods of denial, anger, and mild to moderate depression at different times until their grief is resolved.

Symptoms of depression that would be of concern postoperatively include major changes in sleeping habits (insomnia or hypersomnia), changes in appetite, crying spells, loss of sexual desire or responsiveness, or agitation and anxiety. Patients may also appear to be recovering too slowly. They may have repeated complaints of weakness, chronic pain without organic pathology, gastrointestinal disturbances, or other vague physical complaints. These patients may be easily identified in postoperative office visits by the nature of their complaint or by their behavior. When questioned about appetite, sleep, and how they are feeling, they usually will freely report their complaints. Although these patients will rarely label their problems as depression or as an inability to reintegrate themselves following surgery, they are very aware of their discomfort and distress. Discussions of their physical state and of how they should feel after surgery are important at this time, but these discussions will be of limited use in relieving the depression. Patients may often request medication for relieving depression or anxiety. This is usually not the best initial course of action. Because the depression is usually related to unresolved grief and an inability to reintegrate the self, a referral for a thorough evaluation of the emotional source of symptoms as well as appropriate counseling and medication, if needed, is the preferred course to follow.

Summary

Although negative emotional sequelae following gynecologic surgery may occur, these reactions do not have to be standard. Understanding and accepting the strong relationship between a woman's reproductive system, her gender identity, and self-concept is crucial to successful resolution of negative emotional reactions. Patients frequently have fantasies and myths about their reproductive organs. If these fantasies and myths can be identified and dealt with prior to surgery, the risk of negative emotional sequelae is greatly reduced. The reason for the surgery also produces variations in emotional reactions. Providing comprehensive information preoperatively and continuing to provide information postoperatively will alleviate many negative emotional reactions and improve recovery. Information about sexual desire and functioning must also be provided with any gynecologic surgery. In cases of radical surgery, the patient must be helped with alternative methods for sexual relations. True psychopathologic reactions postoperatively can be easily identified by observing the patient and by questioning for signs and symptoms of depression. The patients with postoperative depression should be referred to the appropriate professional to facilitate both emotional and physical recovery. Although the main concern of the gynecologic surgeon must be surgery and physical recovery, knowledge of and attention to psychosocial aspects of this surgery will serve to improve patient recovery, enhance the physician-patient relationship, and aid in providing the best possible medical care.

References

1. Anderson BL, Hacker NF: Psychosexual adjustment of gynecologic oncology patients: A proposed model for future investigation. *Gynecol Oncol* 1983; 15:214–233.
2. Barnes AB, Zuspan FP: Patient's reactions to puerperal surgical sterilization. *Am J Obstet Gynecol* 1958; 75:65–71.
3. Cain E, Kohorn E, Quinlan D, et al: Psychological reactions to the diagnosis of gynecologic cancer. *Obstet Gynecol* 1983; 62:635–641.
4. Daly MJ: Psychological impact of surgical procedures in women, in Freedman

AM, Kaplan HI, Sadock BJ (eds): *Comprehensive Textbook of Psychiatry,* II. Baltimore: Williams & Wilkins Company, 1975, vol 2, pp 1477–1480.

5. Dzuirbejko M, Larkin J: Including the family in preoperative teaching. *Am J Nurs* 1978; 78:1892–1894.
6. Egbert LD, Battit EW, Welch CE, et al: Reduction of postoperative pain by encouragement and instructions of patients. *N Engl J Med* 1964; 270:825–831.
7. Fisher SG: Psychosexual adjustment following total pelvic exenteration. *Cancer Nursing* 1979; 2:219–225.
8. Freud S: *The Basic Writings of Sigmund Freud,* New York: Modern Library, 1983.
9. Hovland CL, Weiss W: The influence of source credibility on communication effectiveness. *Public Opinion* 1952; 15:635–637.
10. Kapit S, Barnes A: Patient response to tubal division. *JAMA* 1976; 236:2761–2763.
11. Kelly S: Out of place. *Nursing Mirror* 1982; 154:35–38.
12. Martin RL, Roberts WV, Clayton PJ: Psychiatric status after hysterectomy: A one-year prospective follow-up. *JAMA* 1980; 244:350–353.
13. Masterson BJ: Ectopic pregnancy, in Masterson BJ (ed): *Manual of Gynecologic Surgery,* 1st ed. New York: Springer-Verlag 1979, pp 187–192.
14. Reading A: Psychological preparation for surgery: Patient recall of information. *J Psychosom Res* 1981; 25:57–62.
15. Roeske N: Hysterectomy and other gynecologic surgeries: A psychological view, in Notman M, Nadelson C (eds): *The Woman Patient: Medical and Psychological Interfaces: Sexual and Reproductive Aspects of Women's Health Care.* New York, Plenum Press, 1978, vol 1, pp 217–231.
16. Seibel M, Freeman MG, Graves WL: Sexual functioning after surgical and radiation therapy for cervical carcinoma. *South Med J* 1982; 75:1195–1197.
17. Thiery M, Goethals A: Psychological sequelae to elective sterilization: A prospective study. *Br Med J (Clin Res)* 1982; 284:1557.
18. Vernon DTA, Bigelow DA: Effect of information about a potentially stressful situation on response to stress impact. *J Pers Soc Psychol* 1974; 29:50–54.

29 Medical Malpractice and Gynecologic Surgery

Larry L. McMullen

The Problem Defined

All too often medical malpractice is understood to mean only some gross departure from accepted conduct. An obstetrician asked to give an example of medical malpractice cited failure to leave the golf course to deliver a patient. The true definition is *any* deviation from what a reasonably prudent physician would do under the same or similar circumstances.

The Proof

The jury will be told at the outset of a medical malpractice trial that they may not judge based upon their personal opinion (since they are unqualified) but only upon the opinions of medical experts (i.e., doctors) called to testify. Unless plaintiff's attorney can produce such a witness, the case will be dismissed by the judge.

In a case combining substantial injury with questionable treatment, a resourceful plaintiff's attorney will have no difficulty in locating a credentialed physician willing to testify that there was malpractice. The availability of such physicians, willing to so testify for pay, is well known.

Thus is made a case for the jury's consideration. However, this by no means ensures a verdict for the plaintiff. If the defendant's conduct was arguably proper (if otherwise the case should be settled), abundant defense medical experts can be produced. They can have the advantage of being local (the local medical school is the best source); experienced primarily in medicine instead of testifying; and giving testimony that they believe in rather than being paid for. By comparison, plaintiff's expert may appear as an experienced "hired gun" testifier, motivated by greed or ego or both. Juries notice this.

The Problem's Origin

A claim for medical malpractice always starts with a bad result. The second step is usually an attorney gleaning the medical record, possibly with the help of a local friendly physician (usually available in return for a promise of nondisclosure) to find possible vulnerabilities in the treatment provided. A current typical case is the brain-damaged neonate. Unreasonable parental expectations for a perfect child, together with the psychological need to shift guilt to the obstetrician, motivates the parents; the high monetary potential motivates the lawyer; and these combine in almost all brain damage cases to cause a careful scrutiny of the records. Woe to the obstetrician who neglected to document what was done and why. Absent this, the plaintiff's attorney has a fair chance of persuading the jury that the obstetrician was not doing or thinking anything!

Necessity of Proving Negligence

Bad results alone will not support a medical malpractice case. The plaintiff's attorney has the burden of proof. This is usually defined to mean "more likely than not" that the injury was caused by substandard conduct. Ordinarily this can be accomplished only by doctors who are willing to testify that the defendant committed malpractice. Lawyers advance medical malpractice cases, but without doctors volunteering to testify in support, medical malpractice cases would vanish.

Alternative Theories of Informed Consent and Battery

It is accepted law in all jurisdictions (though certainly not yet accepted by all physicians) that a surgical patient has the right to be informed of the nature of her problem, the alternatives for possible treatment, the important risks attendant upon same, and to then decide upon a course of action. Failure to impart such information will subject the surgeon to liability for a bad result, provided it is proved that furnishing the information would have prevented the injury. Most often the theory of "lack of informed consent" is thrown in as a make-weight, to bolster other allegations of negligent conduct. A case standing alone on "informed consent" is not considered strong, primarily because the jury is not likely to believe that the outcome would have been any different even if the information had been provided.

In most jurisdictions the plaintiff must produce an expert witness to explain what information should have been given to the patient. A clever plaintiff's attorney may avoid this necessity by having the unwary defendant doctor testify in his deposition that it would be below standard not to impart the information that the defendant says was given. Of course, the plaintiff will deny it, and the jury will get to decide.

A cousin of "informed consent" is the theory of unauthorized touching (a "battery"), such as where the gynecologist performs an incidental appendectomy without specific consent. Here lack of significant damage prevents much of a case. But suppose an obstetrician delivered with forceps where it had been agreed in prenatal visits not to do so, and a fractured skull resulted. Fortunately, it could be shown that the "battery" was waived when the father stood by and raised no objection.

Defensive Practice to Prevent the Problem

Defensive medicine does not mean doing the unnecessary as is sometimes supposed. It does mean establishing the right relationship with your patient and carefully documenting what you do and why.

The obstetrician/gynecologist has an excellent opportunity to establish rapport with the patient. Obstetrical events and gynecologic diseases are milestones in a woman's life. She expects both good care and supportive attention. The patient knows when her best interests are the practitioner's first concern. A patient is more inclined to understand a poor result when it has been fully explained. She may even overlook an honest mistake despite the advice of an attorney if her physician has been honest with her. Simple practices can demonstrate your concern. Personalize your care and treatment. Don't keep the patient waiting. This is a misuse of her time which is as valuable to her as your time is to you. Follow up telephone calls promptly and inquire how the patient is doing after surgical procedures. Demonstrate your concern when things are going poorly. Remember, the patient does not know about all the efforts you make for her that are not performed in her presence. Charting, rounds, intensive care visits and conferences with consultants escape her notice unless they are explained to her and her family. None of us wishes to bear bad news. If things are going poorly, transmit more information, more frequently—not the opposite. A feeling of trust and confidence is awarded to the physician who is open, interested and informative. Law suits are rare when these rather simple principles are pursued.

While endeavoring to prevent a suit, care must be taken in every case that will allow a defense, should a suit occur. This means documenting the office and hospital record every time your patient is seen. All medical malpractice lawsuits are tried on the written record. Entries made long before contemplation of a lawsuit will be believed.

The cornerstone of every medical malpractice defense is that although the result was bad, and in retrospect something different might have been done, the defendant doctor was exercising the best medical judgment at the time. Juries in most jurisdictions are receptive to a doctor's explanation, and the "medical judgment" explanation will most often prevail if the record shows that the doctor was there and thinking about the patient.

Almost all medical malpractice cases are born with a marriage of these elements:

1. Bad results
2. Poor physician-patient relationships
3. A deficient record that allows a plaintiff's attorney to believe that you were not thinking about your patient at all (Fig. 29-1).

Don't worry about (1), you cannot keep it from happening. Constructive worry about (2) and (3) may keep you from getting sued when the bad result does happen.

Surgical Failures

Before the Problem

Suits from surgical complications (except in cases of clear negligent mistakes, which should be settled) most often result from the patient's failure to understand the possibility of complications beforehand. A bowel burn from electrocautery tubal ligation; a total abdominal hysterectomy to remove a mass presumed to be a diseased uterus that turns out to be only omental adhesions; and births following sterilization by tubal ligation produce suits because of failure by the patient to understand that such complications were possible or failure by the gynecologist to document in the office and hospital record (by the consent form *and* a note in the progress record) that the patient was so advised. Obviously, not every possible complication can be discussed. But those that occur with some frequency must be mentioned specifically. For example, a sterilization patient should always be advised of a 1% to 3% failure rate and that she could become pregnant. Overemphasis on discussing sterility, while at the same time neglecting the possibility of pregnancy,

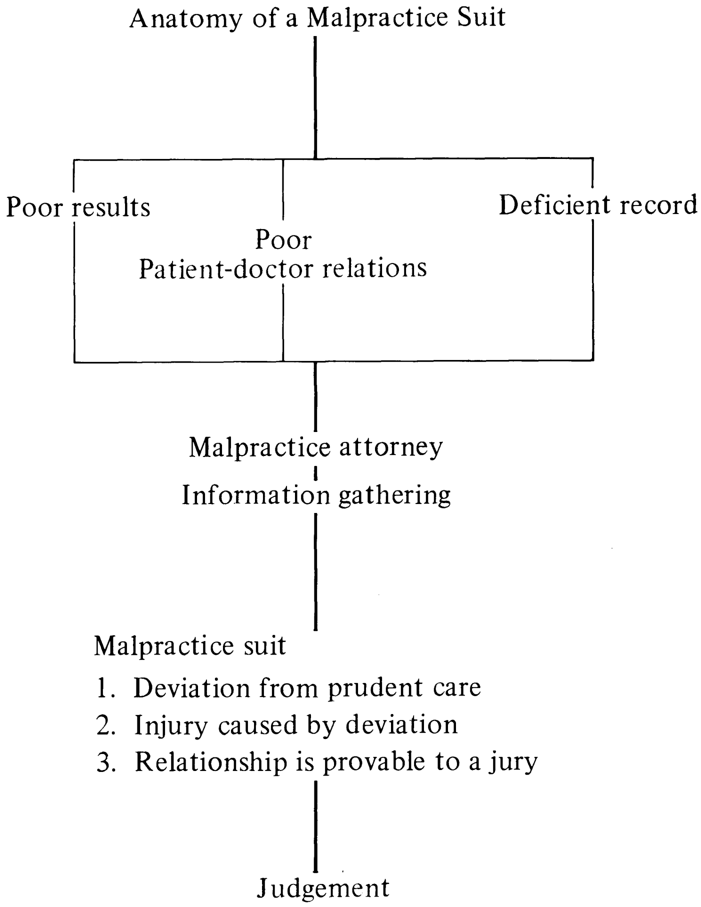


FIGURE 29-1. Anatomy of a Malpractice Suit

has been taken in some cases to amount to a guarantee of sterility. Such has helped fuel the proliferation of so-called "wrongful birth" cases.

After mention of appropriate specific complications, the patient should be advised: "and there are the general risks of hemorrhage, infection, and damage to adjacent structures that are present in every surgery" and finally, "You may be unimproved or even worse following the procedure." Such seemingly harsh advice is what the patient has a right to hear and what you have an obligation to say. It may be tempered with reasonable assurances of your skill and ability to handle complications, but the basic truth must be told *and recorded.*

After the Fact

Most surgeons are chagrined to be faced with a bad result. It is often difficult to discuss this with the patient and family. The physician may feel that under the stress of the problem, the wrong thing may be said.

Complications should be discussed openly and immediately. Failure to do so may be viewed as an implication of guilt and encourage a suit. The resentment caused by no discussion far outweighs the risk of saying the wrong thing.

How a Case Is Defended

Neither perfect medical care nor guaranteed results are expected. The jury must only be persuaded that the physician acted reasonably and used his best medical judgment. This requires that the jury be taught the medical facts and options, and why a particular course was followed.

Contrary to popular belief among surgeons, a lay jury is capable of sufficient medical understanding to reach a just result. The jury is very concerned about judging the case fairly and will eagerly attempt to learn the essentials of the case. The side that does the best job of education usually prevails. The medical defendant and his attorney are in the best position to properly inform the jury. A case that is defensible requires only a proper attitude and diligent preparation to most often bring a happy ending to an unhappy experience.

Selected Bibliography

Alton WG Jr: *Malpractice: A Trial Lawyer's Advice for Physicians.* Boston, Little Brown & Co, 1977.

Lawyers' Co-Op Editorial Staff. *Medical Malpractice: Cases and Annotations,* ALR 2nd. Rochester, NY, Lawyers' Cooperative Publishing Company, 1966.

Louisell DW, Williams H: *Medical Malpractice.* New York, Matthew Bender & Co, 1984.

Pegalis S, Wachsman H: *American Law of Medical Malpractice.* Rochester, NY, Lawyers' Cooperative Publishing Company, 1980.

Selected Bibliography

Blaustein A (ed.): Pathology of the Female Genital Tract. 2nd ed. New York, Springer-Verlag, 1982.

Boileau JC: Grant—An Atlas of Anatomy, 7th ed. Baltimore, Williams & Wilkins, 1978.

Krantz KE: Anatomy of the female reproductive system. In Benson RC (ed.): Current Obstetrics and Gynecologic Diagnosis and Treatment. 5th ed. Los Altos, Lange, 1984.

Plentl AA and Friendman EA: Lymphatic Systemic of the Female Genitalia. Philadelphia, Saunders, 1971.

Sobotta J: Atlas of Human Anatomy, 8th ed., vols. 1–3 (revised by Figge, FHJ). New York, Hafner, 1963.

Thorek P: Anatomy in Surgery, 3rd ed. New York, Springer-Verlag 1985.

Uhlenhuth E: Problems in the Anatomy of the Pelvis, An Atlas. Philadelphia, Lippincott, 1953.

Index