THIRD EDITION

Williams GYNECOLOGY

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Williams GYNECOLOGY

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THIRD EDITION

Barbara L. Hoffman, MD
John O. Schorge, MD
Karen D. Bradshaw, MD
Lisa M. Halvorson, MD
Joseph I. Schaffer, MD
Marlene M. Corton, MD

New York Chicago San Francisco Lisbon London Madrid Mexico City
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DEDICATION

This edition of *Williams Gynecology* is dedicated to David L. Hemsell, MD, who served as Director of the Division of Gynecology at the University of Texas Southwestern Medical Center and Parkland Memorial Hospital for more than 20 years. During this tenure, his national awards have included a Meritorious Achievement award from the Infectious Diseases Society of America and an Outstanding Service award from the American College of Obstetricians and Gynecologists.

Early in his training, Dr. Hemsell joined the Air Force and served our country as a Flight Medical Officer. In these years, he pursued specialty training in reproductive endocrinology with Dr. Paul MacDonald. He joined our faculty as the Division Director of Gynecology in 1977. In addition to his Director role, Dr. Hemsell was the Chief of Gynecology at Parkland Memorial Hospital and Medical Director of the Parkland Obstetrics and Gynecology Emergency Room. In these roles, Dr. Hemsell created an environment in which evidence-based medicine was the standard for care. Accordingly, patients, residents, and junior faculty all benefitted from this scientific health care approach. He also served as Director of the Faculty Sexual Assault Examination and Testimony Program. In that role, he coordinated the examinations of many thousands of sexual assault victims and the collection of legal evidence. As a result of his efforts, Dallas County has a system regarded as among the best in medical and legal care for these victims.

During his academic career, Dr. Hemsell added foundational knowledge regarding the etiology, pathogenesis, and treatment of female pelvic infections, especially those following gynecologic surgeries. With this expertise, he served as journal reviewer for multiple journals. He has added to academic knowledge through his nearly 50 book chapters and 100 peer-reviewed articles on multiple gynecologic topics.

For us in the Department of Obstetrics and Gynecology, Dr. Hemsell plays an important role of mentor and colleague. His experience and clinical expertise are invaluable and provide a valuable sounding board for challenging gynecology cases. On so many levels, we have benefitted greatly from his academic and clinical contributions.

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EDITORS

Barbara L. Hoffman, MD
Associate Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas

John O. Schorge, MD, FACOG, FACS
Chief of Gynecology and Gynecologic Oncology
Associate Professor, Department of Obstetrics and Gynecology
Massachusetts General Hospital–Harvard Medical School

Karen D. Bradshaw, MD
Holder, Helen J. and Robert S. Strauss and Diana K. and Richard C. Strauss Chair in Women's Health
Director, Lowe Foundation Center for Women's Preventative Health Care
Professor, Department of Obstetrics and Gynecology
Professor, Department of Surgery
University of Texas Southwestern Medical Center at Dallas

Lisa M. Halvorson, MD
Bethesda, Maryland

Joseph I. Schaffer, MD
Holder, Frank C. Erwin, Jr. Professorship in Obstetrics and Gynecology
Director, Division of Gynecology
Director, Division of Female Pelvic Medicine and Reconstructive Surgery
Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chief of Gynecology, Parkland Memorial Hospital, Dallas

Marlene M. Corton, MD, MSCS
Director, Anatomical Education and Research
Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas

Atlas Art Director

Lewis E. Calver, MS, CMI, FAMI
Associate Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas

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CONTRIBUTORS

April A. Bailey, MD
Assistant Professor, Department of Radiology
Assistant Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 2: Techniques Used for Imaging in Gynecology
Co-Director of Radiologic Images for Williams Gynecology

Sunil Balgobin, MD
Assistant Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 40: Intraoperative Considerations

Karen D. Bradshaw, MD
Holder, Helen J. and Robert S. Strauss and Diana K. and Richard C. Strauss Chair in Women's Health
Director, Lowe Foundation Center for Women's Preventative Health Care
Professor, Department of Obstetrics and Gynecology
Professor, Department of Surgery
University of Texas Southwestern Medical Center at Dallas
Chapter 13: Psychosocial Issues and Female Sexuality
Chapter 18: Anatomic Disorders
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Anna R. Brandon, PhD, MCS, ABPP
Women's Mood Disorders Center
Department of Psychiatry
University of North Carolina at Chapel Hill School of Medicine
Department of Psychiatry
University of Texas Southwestern Medical Center at Dallas
Chapter 13: Psychosocial Issues and Female Sexuality

Matthew J. Carlson, MD
Assistant Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 34: Uterine Sarcoma

Kelley S. Carrick, MD
Professor, Department of Pathology
University of Texas Southwestern Medical Center at Dallas
Director of Surgical Pathology Images for Williams Gynecology

Marlene M. Corton, MD, MSCS
Director, Anatomical Education and Research
Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 25: Anal Incontinence and Functional Anorectal Disorders
Chapter 38: Anatomy
Chapter 43: Surgeries for Benign Gynecologic Disorders
Chapter 45: Surgeries for Pelvic Floor Disorders

Kevin J. Doody, MD
Director, Center for Assisted Reproduction, Bedford, TX
Clinical Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 20: Treatment of the Infertile Couple

David M. Euhus, MD
Professor, Department of Surgery
Johns Hopkins Hospital/University
Chapter 12: Breast Disease

Rajiv B. Gala, MD, FACOG
Vice-Chair, Department of Obstetrics and Gynecology
Residency Program Director, Department of Obstetrics and Gynecology
Ochsner Clinic Foundation
Associate Professor of Obstetrics and Gynecology
University of Queensland
Ochsner Clinical School
Chapter 7: Ectopic Pregnancy
Chapter 39: Preoperative Considerations
Chapter 42: Postoperative Considerations

William F. Griffith, MD
Medical Director, OB/GYN Emergency Services
Director, Vulvology Clinic
Co-Director, Dysplasia Services
Parkland Health and Hospital System, Dallas, Texas
Associate Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 4: Benign Disorders of the Lower Genital Tract
Chapter 29: Preinvasive Lesions of the Lower Genital Tract

Lisa M. Halvorson, MD
Bethesda, Maryland
Chapter 6: First-Trimester Abortion
Chapter 15: Reproductive Endocrinology
Chapter 16: Amenorrhea
Chapter 19: Evaluation of the Infertile Couple

Cherine A. Hamid, MD
Medical Director—Gynecology
Parkland Health and Hospital Systems, Dallas, Texas
Associate Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 40: Intraoperative Considerations

Barbara L. Hoffman, MD
Associate Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 1: Well Woman Care
Chapter 8: Abnormal Uterine Bleeding
Chapter 9: Pelvic Mass
Chapter 10: Endometriosis
Chapter 11: Pelvic Pain
Chapter 40: Intraoperative Considerations
Chapter 43: Surgeries for Benign Gynecologic Disorders
Chapter 45: Surgeries for Pelvic Floor Disorders

Siobhan M. Kehoe, MD
Assistant Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 33: Endometrial Cancer

Kimberly A. Kho, MD, MPH, MSCS, FACOG
Assistant Professor, Department of Obstetrics and Gynecology
Director of Gynecology, Southwestern Center for Minimally Invasive Surgery
University of Texas Southwestern Medical Center at Dallas
Chapter 41: Minimally Invasive Surgery Fundamentals
Chapter 44: Minimally Invasive Surgery

Jayanthi S. Lea, MD
Patricia Duniven Fletcher Distinguished Professor in Gynecologic Oncology
Director, Gynecologic Oncology Fellowship Program
Associate Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 31: Vulvar Cancer
Chapter 46: Surgeries for Gynecologic Malignancies

Eddie H. McCord, MD
Associate Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 3: Gynecologic Infection

David Scott Miller, MD, FACOG, FACS
Holder, Dallas Foundation Chair in Gynecologic Oncology
Medical Director of Gynecology Oncology
Parkland Health and Hospital System, Dallas, Texas
Director, Gynecologic Oncology Fellowship Program
Director of Gynecologic Oncology
Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 33: Endometrial Cancer
Chapter 34: Uterine Sarcoma

Elysia Moschos, MD
Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Administrative Director of Gynecologic Ultrasound
Parkland Health and Hospital System
Chapter 2: Techniques Used for Imaging in Gynecology
Co-Director of Radiologic Images for Williams Gynecology

David M. Owens, MD
Assistant Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 11: Pelvic Pain

Mary Jane Pearson, MD
Director, Third-year & Fourth-Year Medical Student Programs
Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 1: Well Woman Care

David D. Rahn, MD
Associate Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 3: Gynecologic Infection
Chapter 23: Urinary Incontinence

Debra L. Richardson, MD, FACOG
Assistant Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 30: Cervical Cancer
Chapter 32: Vaginal Cancer

David E. Rogers, MD, MBA
Associate Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 11: Pelvic Pain

Anthony H. Russell
Associate Professor
Department of Radiation Oncology
Massachusetts General Hospital—Harvard Medical School
Chapter 28: Principles of Radiation Therapy

Andrea L. Russo, MD
Assistant Professor
Department of Radiation Oncology
Massachusetts General Hospital—Harvard Medical School
Chapter 28: Principles of Radiation Therapy

John O. Schorge, MD, FACOG, FACS
Chief of Gynecology and Gynecologic Oncology
Associate Professor, Department of Obstetrics and Gynecology
Massachusetts General Hospital—Harvard Medical School
Chapter 27: Principles of Chemotherapy
Chapter 33: Endometrial Cancer
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Joseph I. Schaffer, MD
Holder, Frank C. Erwin, Jr. Professorship in Obstetrics and Gynecology
Chief of Gynecology
Parkland Health and Hospital System, Dallas, Texas
Director, Division of Gynecology
Director, Division of Female Pelvic Medicine and Reconstructive Surgery
Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 24: Pelvic Organ Prolapse
Chapter 45: Surgeries for Pelvic Floor Disorders

Geetha Shivakumar, MD, MS
Mental Health Trauma Services, Dallas VA Medical Center
Assistant Professor, Department of Psychiatry
University of Texas Southwestern Medical Center at Dallas
Chapter 13: Psychosocial Issues and Female Sexuality

Gretchen S. Stuart, MD, MPHTM
Director, Family Planning Program
Director, Fellowship in Family Planning
Assistant Professor, Department of Obstetrics and Gynecology
University of North Carolina at Chapel Hill
Chapter 5: Contraception and Sterilization

Mayra J. Thompson, MD, FACOG
Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 41: Minimally Invasive Surgery Fundamentals
Chapter 44: Minimally Invasive Surgery

Clifford Y. Wai, MD
Director, Fellowship Program in Female Pelvic Medicine and Reconstructive Surgery
Associate Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 23: Urinary Incontinence
Chapter 26: Genitourinary Fistula and Urethral Diverticulum

Claudia L. Werner, MD
Medical Director of Dysplasia Services
Co-Director Vulvology Clinic
Parkland Health and Hospital System, Dallas, Texas
Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 4: Benign Disorders of the Lower Genital Tract
Chapter 29: Preinvasive Lesions of the Lower Genital Tract

Ellen E. Wilson, MD
Director of Pediatric and Adolescent Gynecology Program
Children's Medical Center, Dallas, Texas
Associate Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas
Chapter 14: Pediatric Gynecology
Chapter 17: Polycystic Ovarian Syndrome and Hyperandrogenism

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ARTISTS

Atlas Art Director

Lewis E. Calver, MS, CMI, FAMI
Associate Professor, Department of Obstetrics and Gynecology
University of Texas Southwestern Medical Center at Dallas

Contributing Atlas Artists

Katherine Brown
Graduate, Biomedical Communications Graduate Program
University of Texas Southwestern Medical Center at Dallas

SangEun Cha
Graduate, Biomedical Communications Graduate Program
University of Texas Southwestern Medical Center at Dallas

T. J. Fels
Graduate, Biomedical Communications Graduate Program
University of Texas Southwestern Medical Center at Dallas

Erin Frederikson
Graduate, Biomedical Communications Graduate Program
University of Texas Southwestern Medical Center at Dallas

Alexandra Gordon
Graduate, Biomedical Communications Graduate Program
University of Texas Southwestern Medical Center at Dallas

Kimberly Hoggatt Krumwiede, MA, CMI
Associate Professor, Health Care Sciences—Education and Research
University of Texas Southwestern Medical Center at Dallas

Richard P. Howdy, Jr.
Former Instructor, Biomedical Communications Graduate Program
University of Texas Southwestern Medical Center at Dallas

Belinda Klein
Graduate, Biomedical Communications Graduate Program
University of Texas Southwestern Medical Center at Dallas

Anne Matuskowitz
Graduate, Biomedical Communications Graduate Program
University of Texas Southwestern Medical Center at Dallas

Lindsay Oksenberg
Graduate, Biomedical Communications Graduate Program
University of Texas Southwestern Medical Center at Dallas

Jordan Pietz
Graduate, Biomedical Communications Graduate Program
University of Texas Southwestern Medical Center at Dallas

Marie Sena
Graduate, Biomedical Communications Graduate Program
University of Texas Southwestern Medical Center at Dallas

Maya Shoemaker
Graduate, Biomedical Communications Graduate Program
University of Texas Southwestern Medical Center at Dallas

Jennie Swensen
Graduate, Biomedical Communications Graduate Program
University of Texas Southwestern Medical Center at Dallas

Amanda Tomasikiewicz
Graduate, Biomedical Communications Graduate Program
University of Texas Southwestern Medical Center at Dallas

Kimberly VanExel
Graduate, Biomedical Communications Graduate Program
University of Texas Southwestern Medical Center at Dallas

Kristin Yang
Graduate, Biomedical Communications Graduate Program
University of Texas Southwestern Medical Center at Dallas

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PREFACE

The first edition of *Williams Obstetrics* was published over a century ago. Since then, the editors of this seminal text have presented a comprehensive and evidenced-based discussion of obstetrics. Patterned after our patriarch, *Williams Gynecology* provides a thorough presentation of gynecology's depth and breadth. In Section 1, general gynecology topics are covered. Sections 2 provides chapters covering reproductive endocrinology and infertility. The developing field of female pelvic medicine and reconstructive surgery is presented in Section 3. In Section 4, gynecologic oncology is discussed.

Traditionally, gynecologic information has been offered within the format of either a didactic text or a surgical atlas. However, because the day-to-day activities of a gynecologist blends these two, so too did we. The initial four sections of our book describe the evaluation and medical treatment of gynecologic problems. The remaining two sections focus on the surgical patient. Section 5 offers detailed anatomy and a discussion of perioperative considerations. Our final section presents an illustrated atlas for the surgical correction of conditions described in Sections 1 through 4. To interconnect this content, readers will find page references within one chapter that will direct them to complementary content in another.

Although discussions of disease evaluation and treatment are evidence based, our text strives to assist the practicing gynecologist and resident. Accordingly, chapters are extensively complemented by illustrations, photographs, diagnostic algorithms, and treatment tables.

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ACKNOWLEDGMENTS

During the creation and production of our textbook, we were lucky to have the assistance and support of countless talented professionals both within and outside our department.

First, a task of this size could not be completed without the unwavering support provided by our Department Chairman, Dr. Steven Bloom, and Vice-Chairman, Dr. Barry Schwarz. Their financial and academic endorsement of our efforts has been essential. Without their academic vision, this undertaking could not have flourished.

In constructing a compilation of this breadth, the expertise of physicians from several departments was needed to add vital, contemporaneous information. We were fortunate to have Dr. April Bailey, with joint appointments in the Department of Radiology and Department of Obstetrics and Gynecology, add her insight and knowledge as a specialist in radiology. Her many stunning images contribute to the academic richness of this edition. From the Department of Pathology, Dr. Kelley Carrick also shared generously from her cadre of outstanding images. She translated her extensive knowledge of gynecologic pathology into concepts relevant for the general gynecologist. From the Department of Surgery at Johns Hopkins University, Dr. David Euhus lent his considerable knowledge of breast disease to contribute both classic and state-of-the-art information to his truly comprehensive chapter, founded on his broad research and clinical expertise. From the Department of Psychiatry here at the University of Texas Southwestern Medical Center at Dallas and from the University of North Carolina at Chapel Hill School of Medicine, we were lucky to have Drs. Geetha Shivakumar and Anna Brandon provide an extensive discussion of psychosocial issues. They expertly distilled a broad topic into a logically organized, practical, and complete presentation. In addition, Dr. Gretchen Stuart, formerly of our department and now a faculty member at the Department of Obstetrics and Gynecology of the University of North Carolina at Chapel Hill, lent her considerable talents in summarizing contraceptive methods and sterilization techniques. Many warm thanks are extended to Dr. Rajiv Gala, also formerly of our department and now of the Ochsner Clinic. Rajiv masterfully organized and summarized chapters on ectopic pregnancy and perioperative practice. His extensive review of the literature and evidence-based writing shines through these chapters. In this edition, new contributors include Drs. Anthony Russell and Andrea Russo from the Department of Radiation Oncology at Massachusetts General Hospital—Harvard Medical School. In their chapter on radiation therapy, they adeptly provided clear explanations of this therapy's fundamentals and offered extensive suggestions for clinical management of patient complications that may be encountered.

Within our own department, the list is too long and the words are too few to convey our heartfelt thanks to all of our department members for their generous contributions. From our Gynecology Division, many thanks are extended to Drs. Elysia Moschos and April Bailey, who sculpted a clear and detailed summary of traditional and new gynecologic imaging tools. In this edition, these two authors updated radiologic images as needed to present ultimate examples of normal anatomy and gynecologic pathology. We were also lucky to have experts in the field of preinvasive lesions of the lower genital tract, Drs. Claudia Werner and William Griffith. They crafted an information-packed discussion of this topic. In addition, Dr. Griffith has been a steadfast advocate of our project and has added extensive photographic content to many of our chapters. Drs. David Rahn and Eddie McCord teamed to update the chapter on gynecologic infection. Their extensive patient-care experience and rigorous literature review added greatly to the academic and clinical value of this chapter. We were also fortunate to have the expert writing talents of Drs. Mayra Thompson and Kimberly Kho, who provided a compelling and comprehensive discussion of minimally invasive surgery. Our textbook benefitted greatly from the clinical savvy and teaching-centric information that David Rogers and David Owens provided to their chapter. Also, Dr. Rogers has been a long-time supporter of our textbook. We are indebted to him for many of the classic surgical photographs in this edition. Intraoperative fundamentals were thoroughly and logically presented by Drs. Cherine Hamid and Sunil Balgobin. Their strengths in clinical practice and resident teaching are evident in their well-organized and essential chapter. Once again, blending experience and academic fundamentals, Dr. Mary Jane Pearson offered a comprehensive but concise primer on well care for the gynecologic patient.

Our Reproductive Endocrinology and Infertility Division provided other talented physicians and writers. Dr. Kevin Doody lent his considerable clinical and academic prowess in the treatment of infertility. He penned a chapter that clearly describes the state of the art in this field. Dr. Doody was also a kind benefactor with his spectacular clinical photographs on the topic and contributed these generously to numerous chapters. In addition, Dr. Ellen Wilson brought her wealth of clinical experience to chapters on pediatric gynecology and androgen excess. Drawing from her academic and clinical expertise, she crafted chapters that presented practical, prescriptive, and comprehensive discussions of these topics.

Dr. Marlene Corton is a skilled urogynecologist and has written extensively on pelvic anatomy. We were thrilled to have her create stunning chapters on anatomy and anal incontinence. Also from the Urogynecology and Female Pelvic Reconstruction Division, Drs. Clifford Wai and David Rahn added expanded content to their chapter on urinary incontinence. Dr. Wai also masterfully updated his chapter on

vesicovaginal fistula and urethral diverticulum. Special thanks are extended to Dr. Ann Word and her contributions to our chapter on pelvic organ prolapse. Her expertise in extracellular matrix remodeling of the female reproductive tract added fundamental content to the discussion of prolapse physiology.

Dr. David Miller generously contributed his talents without hesitation, and we are indebted to him for his altruism toward our project. In addition, the Division of Gynecologic Oncology offered a deep bench of talented writers. The topic of vulvar cancer was thoroughly covered by Dr. Jayanthi Lea. Dr. Lea also assisted with updating our atlas and added essential steps for minimally invasive approaches. Her strengths in clinical practice and resident teaching are evident in her well-organized and evidence-based chapters. We also benefitted from Dr. Debra Richardson's comprehensive presentation and clinical discussions of cervical and vaginal cancer in her two chapters. She has been a true advocate of both the text and study guide. Dr. Siobhan Kehoe described with clarity and clinical relevance the care and treatment of women with endometrial cancer. We were appreciative of Dr. Matthew Carlson, who teamed with David Miller to present the varied pathology and treatment of uterine sarcoma.

With this edition, several of our valued authors have turned their efforts to other promising pursuits. We are grateful to Drs. F. Gary Cunningham, Bruce Carr, David Hemsell, Larry Word, and Phuc Nguyen for their prior contributions to *Williams Gynecology*. All with well-known and well-established careers, they generously contributed their academic skills without hesitation. We are indebted to them for their altruism toward our project.

Of these academicians, Dr. F. Gary Cunningham provided the academic vision that led to the creation of this text. Dr. Cunningham has been the senior author for seven editions of Williams Obstetrics, spanning over 25 years. As such, we benefited greatly from his writing genius, his meticulous organization, and his tenacity to task. His dedication to evidence-based medicine established the foundation on which our textbook was built. We feel privileged to have learned the craft of clear, concise academic summary from a consummate master.

New beautiful and detailed artwork in our atlas this edition was drawn by Mr. Lewis Calver, here at the University of Texas Southwestern Medical Center at Dallas. Again for this edition, he paired his academic talents with Dr. Marlene Corton to create updated hysterectomy and urogynecologic images. Both of these anatomists committed countless hours in the cadaver laboratory and in the library to create academically new presentations. These renderings were crafted and tailored with the gynecologic surgeon in mind to depict important techniques and anatomy for these surgeries. Dr. Jayanthi Lea joined this gifted duo to add complementary and informative illustrations to her description of minimally invasive cancer surgeries.

We also acknowledge the efforts of our atlas artists from the first two editions: Marie Sena, Erin Frederikson, Jordan Pietz, Maya Shoemaker, SangEun Cha, Alexandra Gordon, Jennie Swensen, Amanda Tomasikiewicz, and Kristin Yang. Additionally, alumni from the Biomedical Communications Program at the University of Texas Southwestern Medical Center provided seminal pieces. These alumni include Katherine Brown, Thomas "T. J." Fels, Belinda Klein, Anne Matuskowitz, Lindsay Oksenberg, Kimberly VanExel, and faculty member Richard P. Howdy, Jr. Also, Ms. Kimberly Hoggatt Krumwiede graciously provided several image series to help clarify the steps and missteps of reproductive tract development.

Within our text, images add powerful descriptive content to our words. Accordingly, many, many thanks are extended to those who donated surgical and clinical photographs. Of our contributors, many beautiful photographs within our book were taken by Mr. David Gresham, Chief Medical Photographer at the University of Texas Southwestern Medical Center. Dave's eye for detail, shading, and composition allowed even simple objects to shine and be illustrated to their full potential. He has been an advocate and valued consultant. Our pathology images were presented at their best thanks to Mr. Mark Smith, a graphics designer here at the University of Texas Southwestern Medical Center. His expertise with micrographs improved the clarity and visual aesthetic of many our microscopic images.

The providers in the Obstetrics and Gynecology Emergency Services (OGES) at Parkland Hospital were huge allies in our acquisition of images to illustrate normal and abnormal gynecologic findings. The skilled women's health care nurse practitioners have been true supporters of our efforts, and we sincerely thank them.

We are truly indebted to our administrative staff. For this project, we were lucky to have Ms. Sandra Davis serve as our primary administrative assistant. We are greatly appreciative of her tremendous efforts, professionalism, and efficiency. Ms. Ellen Watkins was a valuable assistant in obtaining needed journal articles. She truly helped to keep our project evidence-based. None of our image and text production would have been possible without the brilliant information technology team in our department. Knowledgeable and responsive, Mr. Charles Richards and Mr. Thomas Ames have supported our project since the first edition. We could not do our job without their expertise.

Williams Gynecology was sculpted into its final form by the talented and dedicated group at McGraw-Hill Education. Once again, Ms. Alyssa Fried has brought her considerable intelligence, energetic work ethic, and creativity to our project. Her attention to detail and organizational talents have kept our project on track with efficiency and style. Our words fall well short in expressing our gratitude to her. Ms. Samantha Williams served as assistant to Ms. Fried, and we extend warm thanks for her tremendous support. Her efficiency, professionalism, hard work, accuracy, and positive attitude made coordination of this project a dream. Mr. Andrew Moyer joined our project during its final sculpting. He has taken our project under his care and has adeptly shepherded it to completion with a calm and efficient style. We happily look forward to many future collaborative editions together.

Without the thoughtful, creative efforts of many, our textbook would be a barren wasteland of words. Integral to this process are Armen Ovsepyan, at McGraw-Hill Education, and Alan Barnett of Alan Barnett Design. Mr. Richard Ruzycka served as production supervisor for this edition of our textbook. He adeptly kept our project on track through an array of potential hurdles. Special

thanks are extended to Mr. Joseph Varghese and Dr. Shetoli Zhimomi at Thomson Digital. They and their artistic team assisted us in revising many of our text images. Their attention to detail and accurate renderings added important academic support to our words.

Our text took its final shape under the watchful care of our compositors at Aptara, Inc. Specifically, we thank Ms. Indu Jawwad for her talents in skillfully and expediently coordinating and overseeing composition. Her dedicated attention to detail and organization were vital to completion of our project. Her pleasant professionalism was appreciated daily. Also at Aptara, Mr. Shashi Lal Das served a crucial task of quality control and assisted in creating beautiful chapter layouts to highlight our content aesthetically and informatively. Special thanks go to Ms. Kristin Landon. As copyeditor for now several editions of both *Williams Obstetrics* and *Williams Gynecology*, Kristin has added precision and clarity to our efforts. Her pleasant and patient professionalism has made our text better.

We offer a sincere "thank you" to our residents in training. Their curiosity keeps us energized to find new and effective ways to convey age-old as well as cutting-edge concepts. Their logical questions lead us to holes in our text, and thereby, always help us to improve our work. Moreover, many of the photographs in this textbook were gathered with the help of our many residents.

In addition, the contributors to this text owe a significant debt to the women who have allowed us to participate in their care. The images and clinical expertise presented in this text would not have been possible without their collaborative spirit to help us move medical knowledge forward.

Last, we offer an enthusiastic and heartfelt "thank you" to our families and friends. Without their patience, generosity, and encouragement, this task would have been impossible. For them, too many hours with "the book" left them with new responsibilities. And importantly, time away from home left precious family memories and laughs unrealized. We sincerely thank you for your love and support.

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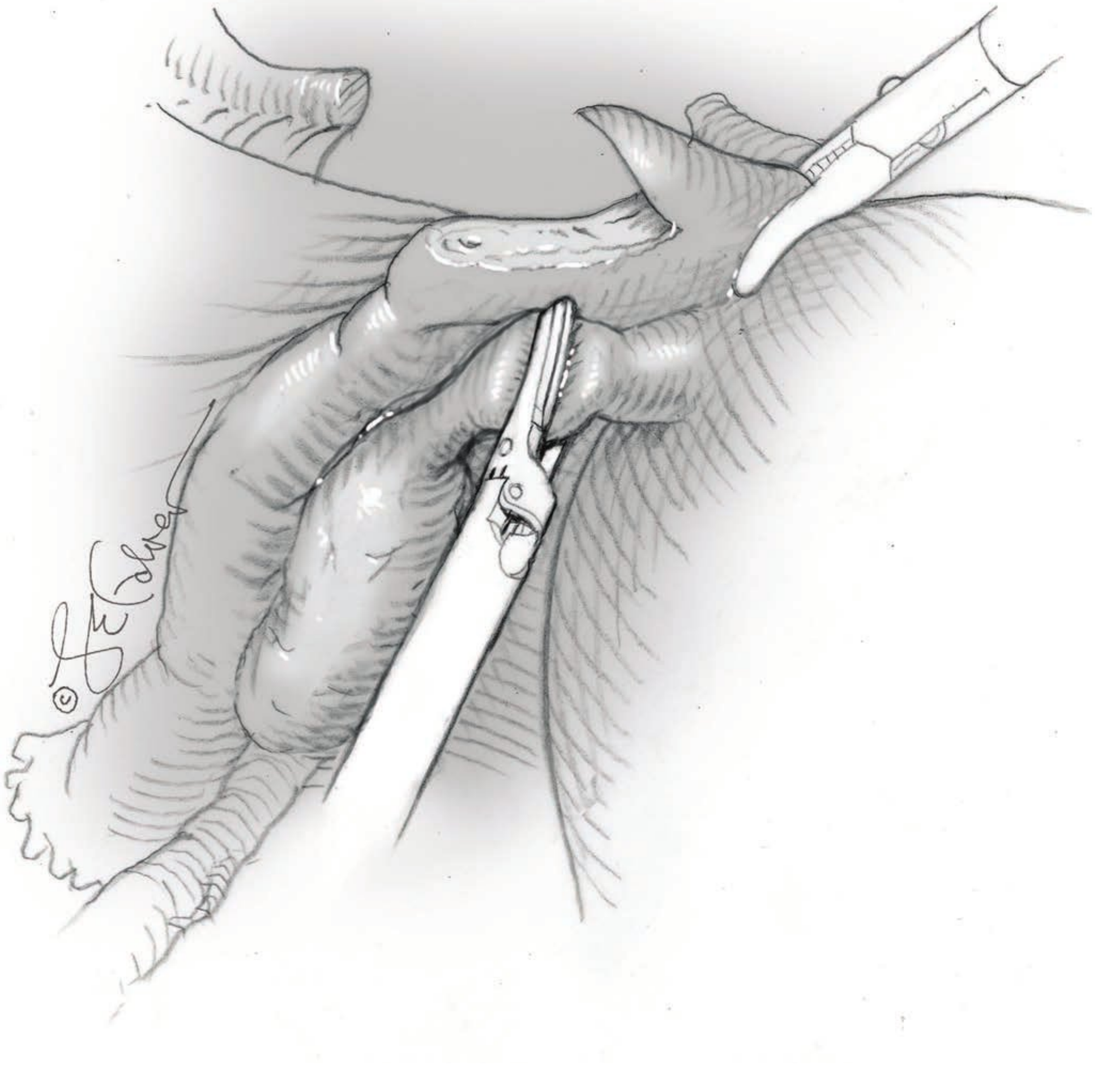
SECTION 1

BENIGN GENERAL GYNECOLOGY



CHAPTER 1

Well Woman Care

Serving as both specialist and primary care provider, a gynecologist has an opportunity to diagnose and treat a wide variety of diseases. Once problems are identified, clinicians, in consultation with the patient, determine how best to manage chronic medical issues based on their experience, practice patterns, and professional interests. Although some conditions may require referral, gynecologists play an essential role in patient screening, in emphasizing ideal health behaviors, and in facilitating appropriate consultation for care beyond their scope of practice.

Various organizations provide preventive care recommendations and update these regularly. Commonly accessed guidelines are those from the American College of Obstetricians and Gynecologists (ACOG), Centers for Disease Control and Prevention (CDC), U.S. Preventive Services Task Force (USPSTF), and American Cancer Society.

MEDICAL HISTORY

During a comprehensive well-woman visit, patients are first queried regarding new or ongoing illness. To assist with evaluation, complete medical, social, and surgical histories are obtained and include obstetric and gynecologic events. Gynecologic topics usually cover current and prior contraceptives; results from prior sexually transmitted disease (STD) testing, cervical cancer screening, or other gynecologic tests; sexual history, described in Chapter 3 (p. 60); and menstrual history, outlined in Chapter 8 (p. 182). Obstetric questions chronicle circumstances around deliveries, losses, or complications. Current medication lists include both prescription and over-the-counter drugs and herbal agents. Also, prior surgeries, their indications, and complications are sought. A social history covers smoking and drug or alcohol abuse. Screening for intimate partner violence or depression can be completed, as outlined on page 18 and more fully in Chapter 13 (p. 298). Discussion might also assess the patient's support system and any cultural or spiritual beliefs that might affect her general health care. A family history helps identify women at risk for familial or multifactorial disease such as diabetes or heart disease. In families with prominent breast, ovarian, or colon cancer, genetic evaluation may be indicated, and criteria are outlined in Chapters 33 (p. 707) and 35 (p. 736). Moreover, a significant family clustering of thromboembolic events may warrant testing, as describe in Chapter 39 (p. 836), especially prior to surgery or hormone initiation. Last, a review of systems, whether performed by the clinician or office staff, may add clarity to new patient problems.

For adults, following historical inventory, a complete physical examination is completed. Many women present to their gynecologist with complaints specific to the breast or pelvis. Accordingly, these are often areas of increased focus, and their evaluation is described next.

PHYSICAL EXAMINATION

Breast Examination

Clinical Evidence

Self breast examination (SBE) is an examination performed by the patient herself to detect abnormalities. However, studies have shown that SBE increases diagnostic testing rates for ultimately benign breast disease and is ineffective in lowering breast cancer mortality rates (Kösters, 2008; T omas, 2002). Accordingly, several organizations have removed SBE from their recommended screening practices (National Cancer Institute, 2015; Smith, 2015; U.S. Preventive Services Task Force, 2009). T at said, the American College of Obstetricians and Gynecologists (2014b) and the American Cancer Society (2014) recommend breast self-awareness as another method of patient self-screening.

Self-awareness focuses on breast appearance and architecture and may include SBE. Women are encouraged to report any perceived breast changes for further evaluation.

In contrast, clinical breast examination (CBE) is completed by a clinical health-care professional and may identify a small portion of breast malignancies not detected with mammography. Additionally, CBE may identify cancer in young women, who are not typical candidates for mammography (McDonald, 2004). One method includes visual inspection combined with axillary and breast palpation, which is outlined in the following section.

T e American College of Obstetricians and Gynecologists (2014b) recommends that women receive a CBE every 1 to 3 years between ages 20 and 39. At age 40, CBE is completed annually. T at said, the USPSTF (2009) and the American Cancer Society report insufficient evidence to recommend routine CBE (Oeffinger, 2015).

Breast Examination

Initially during CBE, the breasts are viewed as a woman sits on the table's edge with hands placed at her hips and with pectoralis muscles f exed (Fig. 1-1). Alone, this position enhances asymmetry. Additional arm positions, such as placing arms above the head, do not add vital information. Breast skin is inspected for breast erythema; retraction; scaling, especially over the nipple; and edema, which is termed peau d'orange change. T e breast and axilla are also observed for contour symmetry.

Following inspection, axillary, supraclavicular, and infraclavicular lymph nodes are palpated most easily with a woman seated and her arm supported by the examiner (Fig. 1-2). T e axilla is bounded by the pectoralis major muscle ventrally and

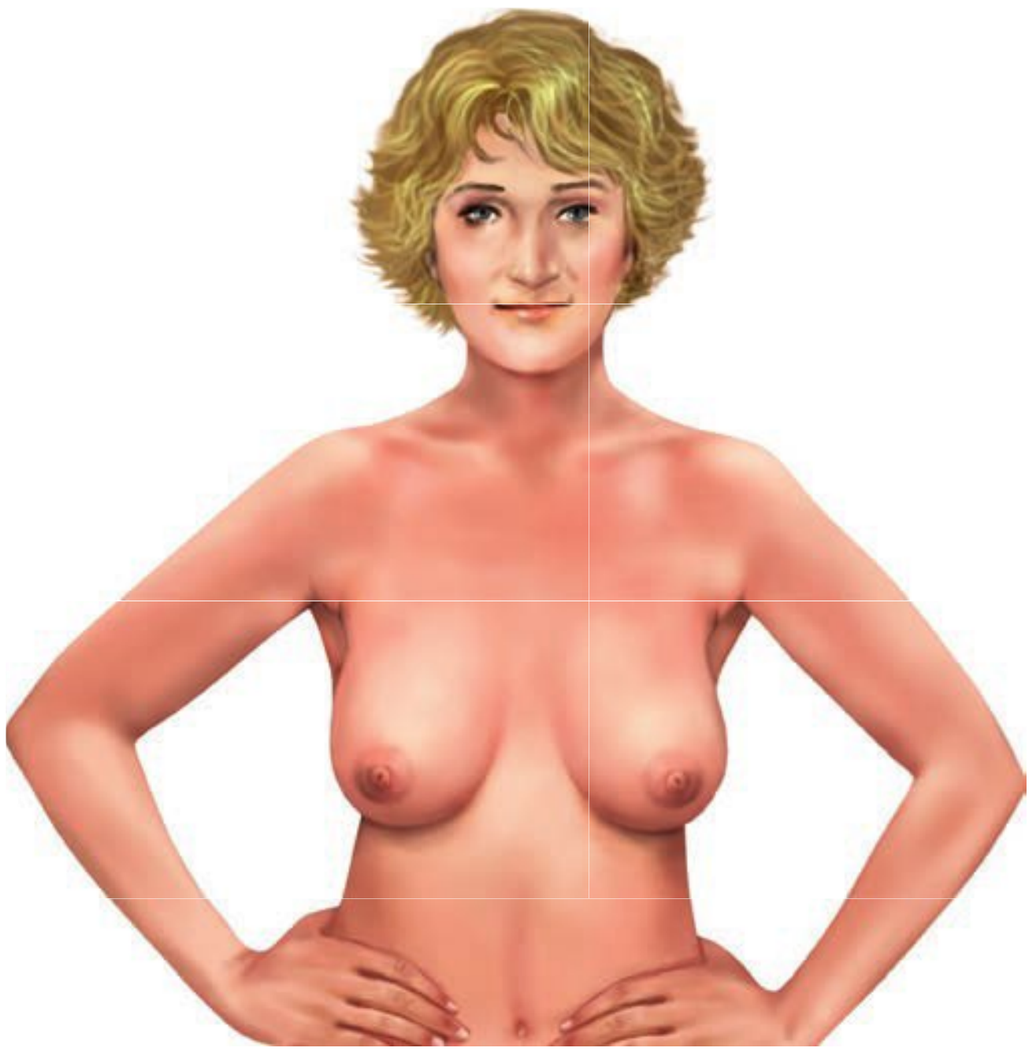


FIGURE 1-1 During visual breast inspection, hands are pressed against the waist to flex the pectoralis muscles. With the patient leaning slightly forward, breasts are visually inspected for breast contour asymmetry or skin dimpling.

FIGURE 1-2 One method of axillary lymph node palpation. Finger tips extend to the axillary apex and compress tissue against the chest wall in the rolling fashion shown in Figure 1-4. The patient's arm is supported by the examiner.

the latissimus dorsi muscle dorsally. Lymph nodes are detected as the examiner's hand glides from high to low in the axilla and momentarily compresses nodes against the lateral chest wall. In a thin patient, one or more normal, mobile lymph nodes less than 1 cm in diameter may commonly be appreciated. T e first lymph node to become involved with breast cancer metastasis (the sentinel node) is nearly always located just behind the midportion of the pectoralis major muscle belly.

After inspection, breast palpation is completed with a woman supine and with one hand above her head to stretch breast tissue across the chest wall (Fig. 1-3). Examination includes breast tissue bounded by the clavicle, sternal border, inframammary crease, and midaxillary line. Breast palpation within this pentagonal area is approached in a linear fashion. Technique uses the finger pads in a continuous rolling, gliding circular motion (Fig. 1-4). At each palpation point, tissues is assessed both superficially and deeply (Fig. 1-5). During CBE, intentional attempts at nipple discharge expression are not required unless a *spontaneous* discharge has been described by the patient.

If abnormal breast findings are noted, they are described by their location in the right or left breast, clock position, distance from the areola, and size. Evaluation and treatment of breast and nipple diseases are described more fully in Chapter 12 (p. 275).

During examination, patients are educated that new axillary or breast masses, noncyclic breast pain, spontaneous nipple discharge, new nipple inversion, and breast skin changes such as dimpling, scaling, ulceration, edema, or erythema should prompt evaluation. T is constitutes breast self-awareness. Patients who desire to perform SBE are counseled on its benefits, limitations, and potential harms and instructed to complete SBE the week after menses.

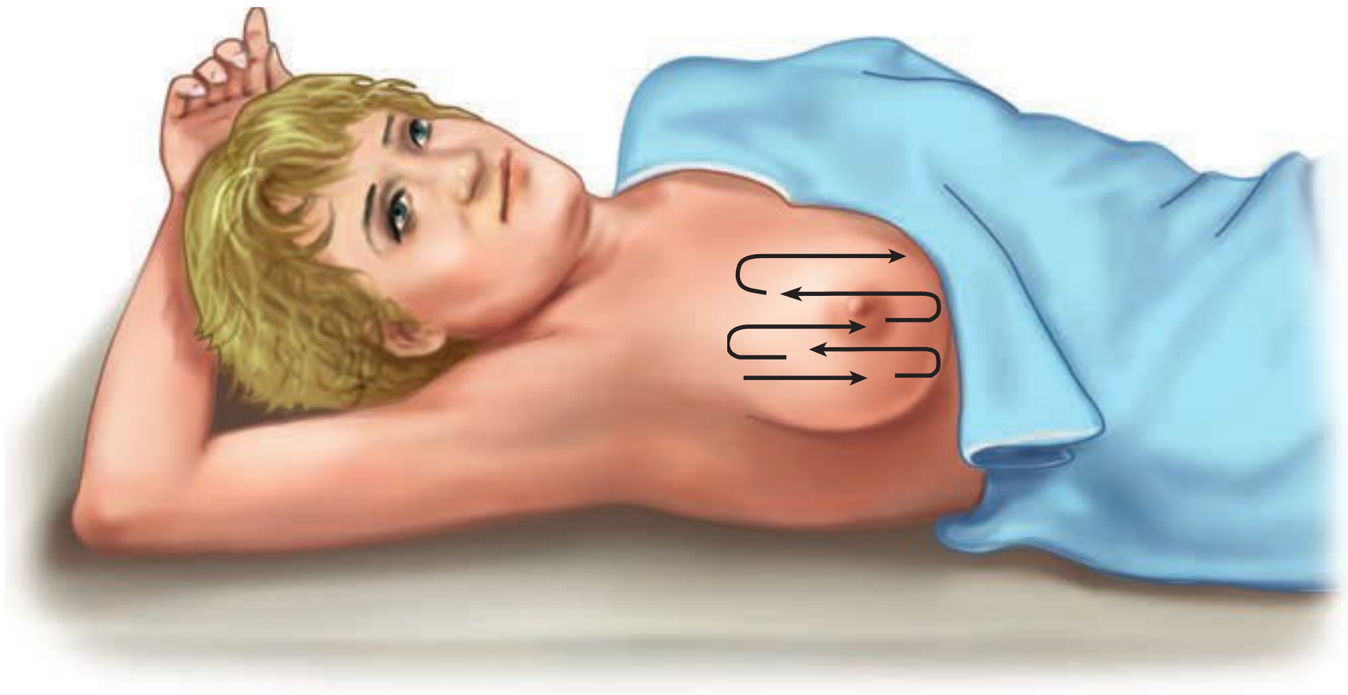


FIGURE 1-3 Recommended patient positioning and direction of palpation during clinical breast examination.

■ Pelvic Examination

This examination is typically performed with a patient supine, legs in dorsal lithotomy position, and feet resting in stirrups. The head of the bed is elevated 30 degrees to relax abdominal wall muscles for bimanual examination. A woman is assured that she may stop or pause the examination at any time. Moreover, each part of the evaluation is announced or described before its performance.

Inguinal Lymph Nodes and Perineal Inspection

Pelvic cancers and infections may drain to the inguinal lymph nodes, and these are palpated during examination. Following this, a methodical inspection of the perineum extends from the mons ventrally, to the genitocrural folds laterally, and to the anus. Notably, infections and neoplasms that involve the vulva can also involve perianal skin. Some clinicians additionally palpate for Bartholin and paraurethral gland pathology. However, in most cases, patient symptoms and asymmetry in these areas will dictate the need for this specific evaluation.

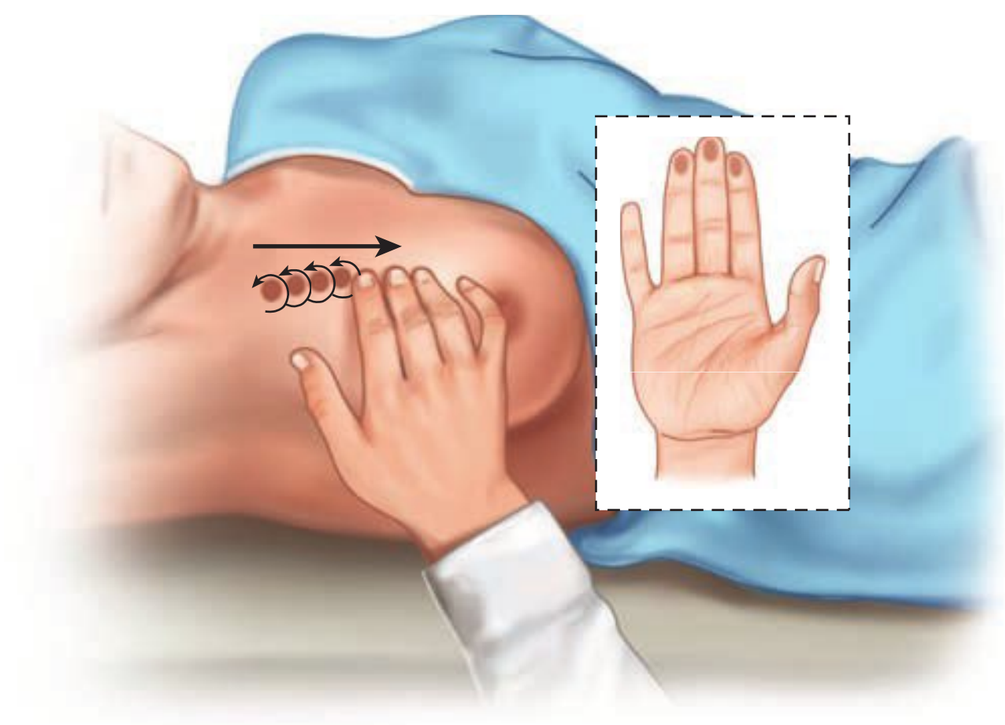


FIGURE 1-4 Recommended palpation technique. The finger pads and a circular rolling motion are used to palpate the entire breast.

Speculum Examination

Both metal and plastic specula are available for this examination, each in various sizes to accommodate vaginal length and laxity. The plastic speculum may be equipped with a small light that provides illumination, whereas metal specula require an external light source. Preference between these two types is provider dependent. The vagina and cervix are typically viewed after placement of either a Graves or Pederson speculum (Fig. 1-6). Prior to insertion, a speculum may be warmed with running water or by warming lights built into some examination tables. Additionally, lubrication may add comfort to insertion. Griffith and colleagues (2005) found that gel lubricants did not increase unsatisfactory Pap smear cytology rates or decrease *Chlamydia trachomatis* detection rates compared with water lubrication. If gel lubrication is used, a dime-sized aliquot is applied sparingly to the outer surface of the speculum blades.

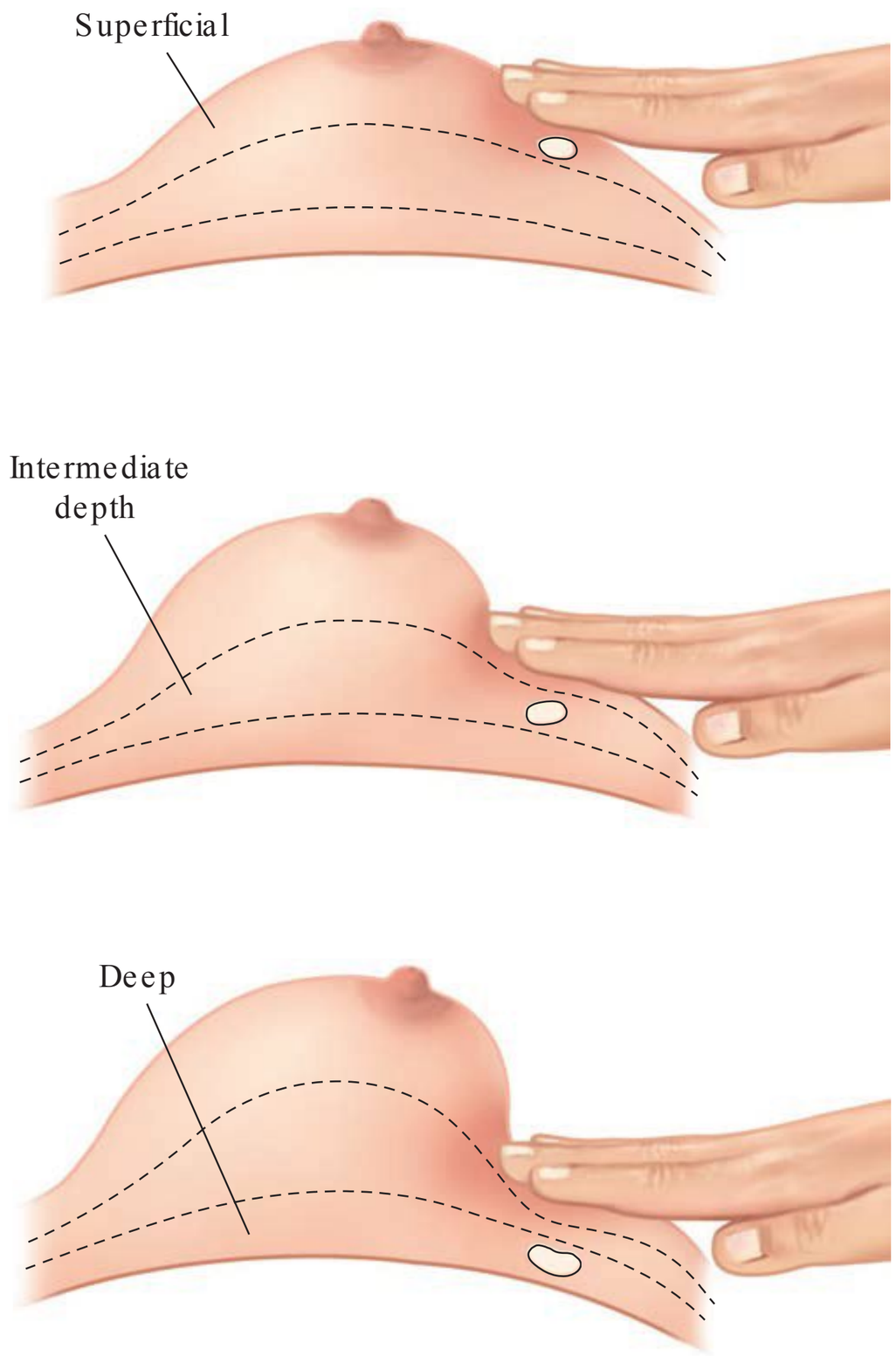


FIGURE 1-5 Palpation through several depths at each point along the linear path.

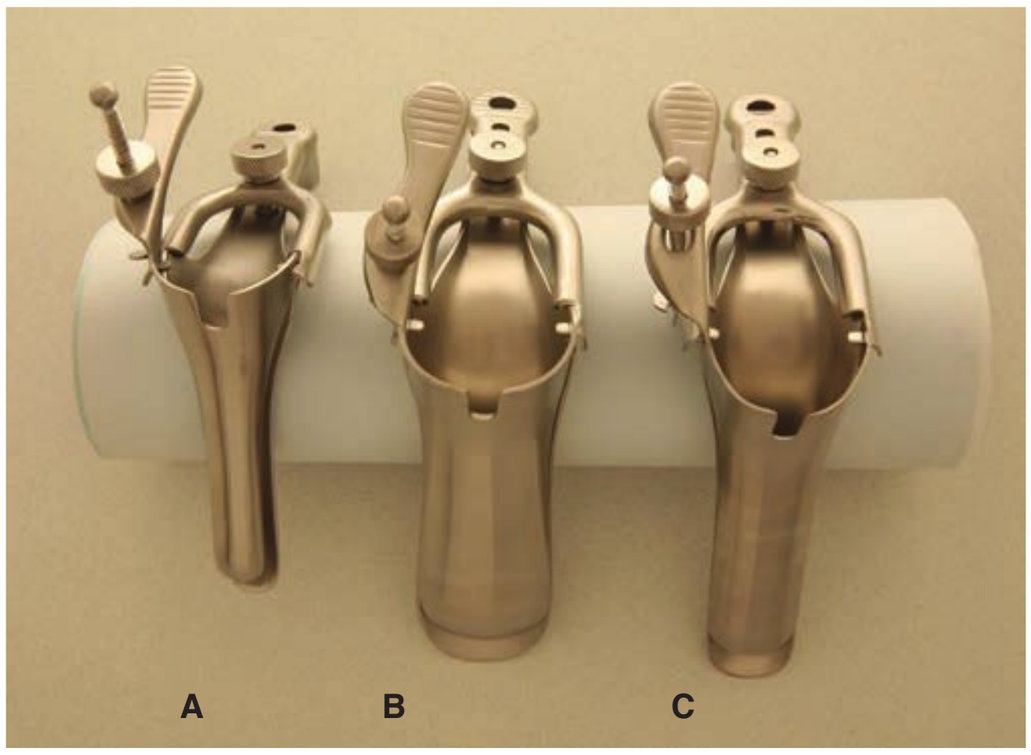


FIGURE 1-6 Vaginal specula. **A.** Pediatric Pederson speculum. This may be selected for child, adolescent, or virginal adult examination. **B.** Graves speculum. This may be selected for examination of parous women with relaxed and collapsing vaginal walls. **C.** Pederson speculum. This may be selected for sexually active women with adequate vaginal wall tone. (Used with permission from US Surgitech, Inc.)

Immediately before insertion, the labia minora are gently separated, and the urethra is identified. Because of urethral sensitivity, the speculum is inserted well below the meatus. Alternatively, prior to speculum placement, an index finger may be placed in the vagina, and pressure placed posteriorly against the bulbospongiosus muscle. A woman is then encouraged to relax this posterior wall to improve comfort with speculum insertion. T is practice may prove especially helpful for women undergoing their first examination and for those with infrequent coitus, dyspareunia, or heightened anxiety.

With speculum insertion, the vagina commonly contracts, and a woman may note pressure or discomfort. A pause at this point typically is followed by vaginal muscle relaxation. As the speculum bill is completely inserted, it is angled approximately 30 degrees downward to reach the cervix. Commonly, the uterus is anteverted, and the ectocervix lies against the posterior vaginal wall (Fig. 1-7).

As the speculum is opened, the ectocervix can be identified. Vaginal walls and cervix are inspected for masses, ulceration, or unusual discharge. As outlined in Chapter 29 (p. 632), cervical cancer screening is often completed, and additional swabs for culture or microscopic evaluation can also be collected. Screening for *Neisseria gonorrhoeae* and *Chlamydia trachomatis* and other STDs is listed in Table 1-1.

Bimanual Examination

Most often, the bimanual examination is performed after the speculum evaluation. Some clinicians prefer to complete the bimanual portion first to better identify cervical location prior to speculum insertion. Either process is appropriate. Uterine and adnexal size, mobility, and tenderness can be assessed during bimanual examination. For women with prior hysterectomy and adnexectomy, bimanual examination is still valuable and can be used to exclude other pelvic pathology.

During this examination, a gloved index and middle finger are inserted together into the vagina until the cervix is reached. For cases of latex allergy, nonlatex gloves are available. To ease insertion, a water-based lubricant can be initially applied to these gloved fingers. Once the cervix is reached, uterine orientation can be quickly assessed by sweeping the index finger inward along the ventral surface of the cervix. In those with an anteverted position, the uterine isthmus is noted to sweep upward, whereas in those with a retroverted position, a soft bladder is palpated. However, in those with a retroverted uterus, if a finger is swept along the cervix's dorsal aspect, the isthmus is felt to sweep downward. With a retroverted uterus, this same finger is continued posteriorly to the fundus and then side-to-side to assess uterine size and tenderness.

To determine the size of an anteverted uterus, fingers are placed beneath the cervix, and upward pressure tilts the fundus toward the anterior abdominal wall. A clinician's opposite

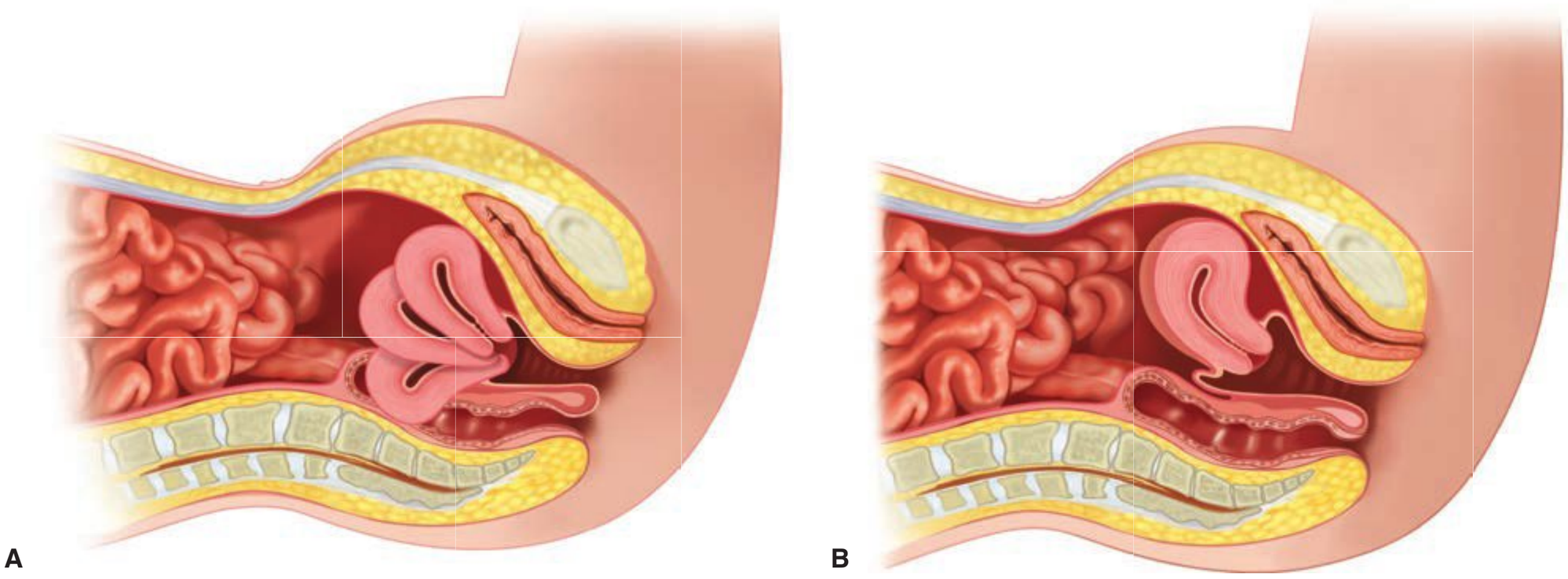


FIGURE 1-7 Uterine positions. **A.** Uterine position may be anteverted, midplane, or retroverted. **B.** As shown here, the uterine fundus can be flexed forward, and this is termed anteflexion. Similarly, the fundus may be flexed backward to create a retroverted uterus.

TABLE 1-1. Sexually Transmitted Disease Screening Guidelines for Nonpregnant, Sexually Active Asymptomatic Women

Infectious Agent	Screening Recommendations	Risk Factors
Chlamydia trachomatis + Neisseria gonorrhoeae	All < 25 yr: annually Those older with risk factors: annually	New or multiple partners; inconsistent condom use; sex work; current or prior STD
Treponema pallidum	Those with risk factors	Sex work; confinement in adult correction facility; MSM
HIV virus	All 13–64 yr: one time[a] Those with risk factors: periodically	Multiple partners; injection drug use; sex work; concurrent STD; MSM; at-risk partners; initial TB diagnosis
Hepatitis C virus	All born from 1945 to 1965: one time Those with risk factors: periodically	Injection/intranasal drug use; dialysis; infected mother; blood products before 1992; unregulated tattoo; high-risk sexual behavior
Hepatitis B virus	Those with risk factors	HIV-positive; injection drug use; affected family or partner; MSM; multiple partners; originate from high-prevalence country
HSV	No routine screening	

[a]Centers for Disease Control and Prevention (2015) and American College of Obstetricians and Gynecologists (2014d) recommend one-time screening between ages 13 and 64 years. The U.S. Preventive Services Task Force (2014b) uses a 15–65 year age range.
HIV = human immunodeficiency virus; HSV = herpes simplex virus; MSM = men having sex with men; STD = sexually transmitted disease; TB = tuberculosis.
Data from Centers for Disease Control and Prevention (2015) and American College of Obstetricians and Gynecologists (2014d); U.S. Preventive Services Task Force (2004a, 2005, 2014a,b).

hand is placed against the abdominal wall to locate the upward fundal pressure (Fig. 1-8).

To assess adnexa, the clinician uses two vaginal fingers to lift the adnexa from the cul-de-sac or from Waldeyer fossa toward the anterior abdominal wall. The adnexa is trapped between these vaginal fingers and the clinician's other hand, which is exerting downward pressure against the lower abdomen. For those with a normal-sized uterus, this abdominal hand is typically best placed just above the inguinal ligament.

Rectovaginal Examination

The decision to perform rectovaginal evaluation varies among providers. Some prefer to complete this evaluation on all adults, whereas others elect to perform rectovaginal examination for those with specific indications. These may include pelvic pain, an identified pelvic mass, rectal symptoms, or risks for colon cancer.

Gloves are changed between bimanual and rectovaginal examinations to avoid contamination of the rectum with potential vaginal pathogens. Similarly, if fecal occult blood testing is to be done at this time, the glove is changed after bimanual examination to minimize false-positive results. Initially, an index finger is placed into the vagina and a middle finger into the rectum (Fig. 1-9). These fingers are swept against one another in a scissoring fashion to assess the rectovaginal septum for scarring or peritoneal studding. The index finger is removed, and the middle finger completes a circular sweep of the rectal vault to exclude masses. If immediate fecal occult blood testing is indicated, it may be performed with a sample from this portion of the examination. As noted later, this single fecal occult blood testing does not constitute adequate colorectal cancer screening.

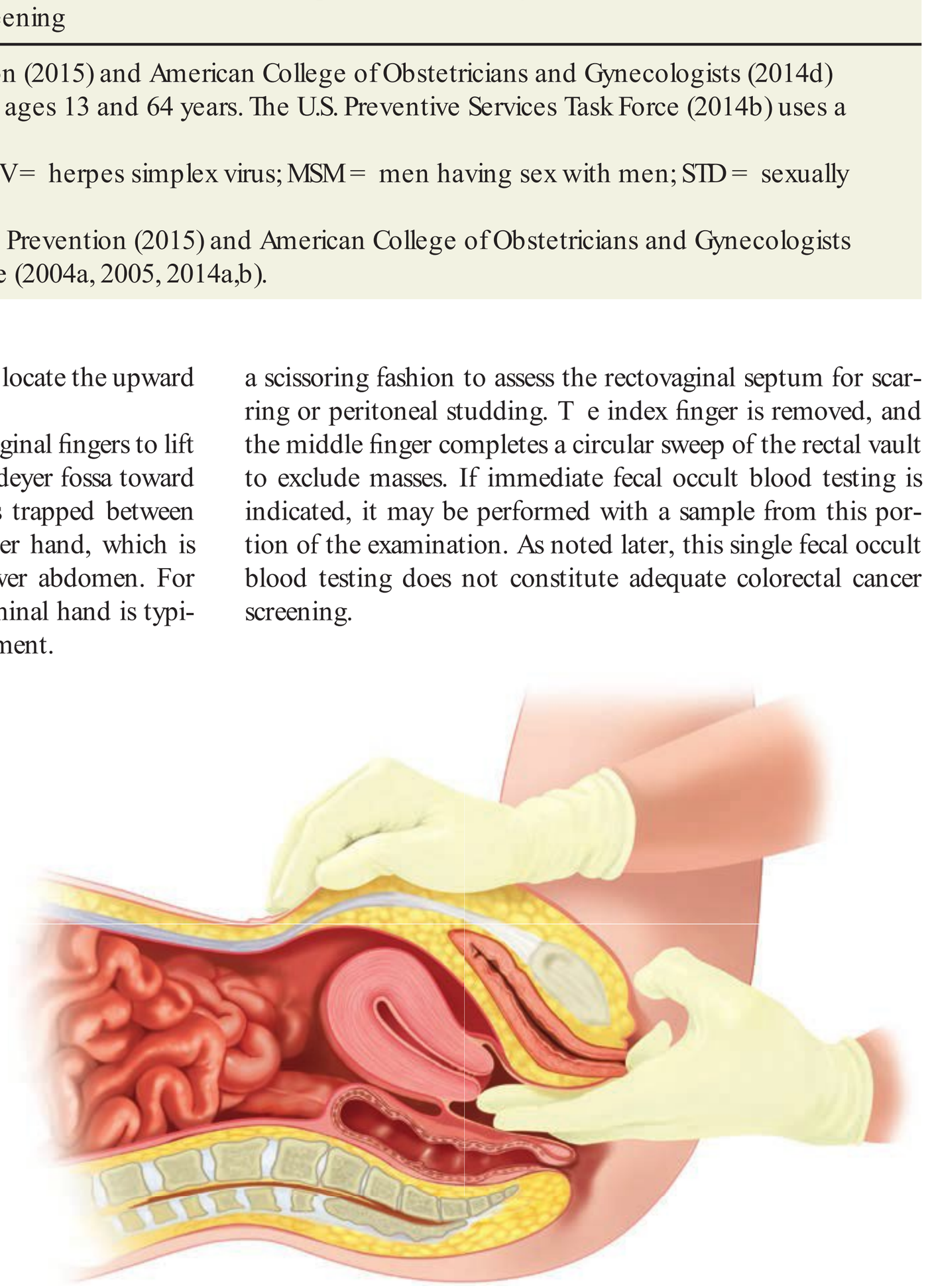


FIGURE 1-8 Bimanual examination. Fingers beneath the cervix lift the uterus toward the anterior abdominal wall. A hand placed on the abdomen detects upward pressure from the uterine fundus. Examination allows assessment of uterine size, mobility, and tenderness.

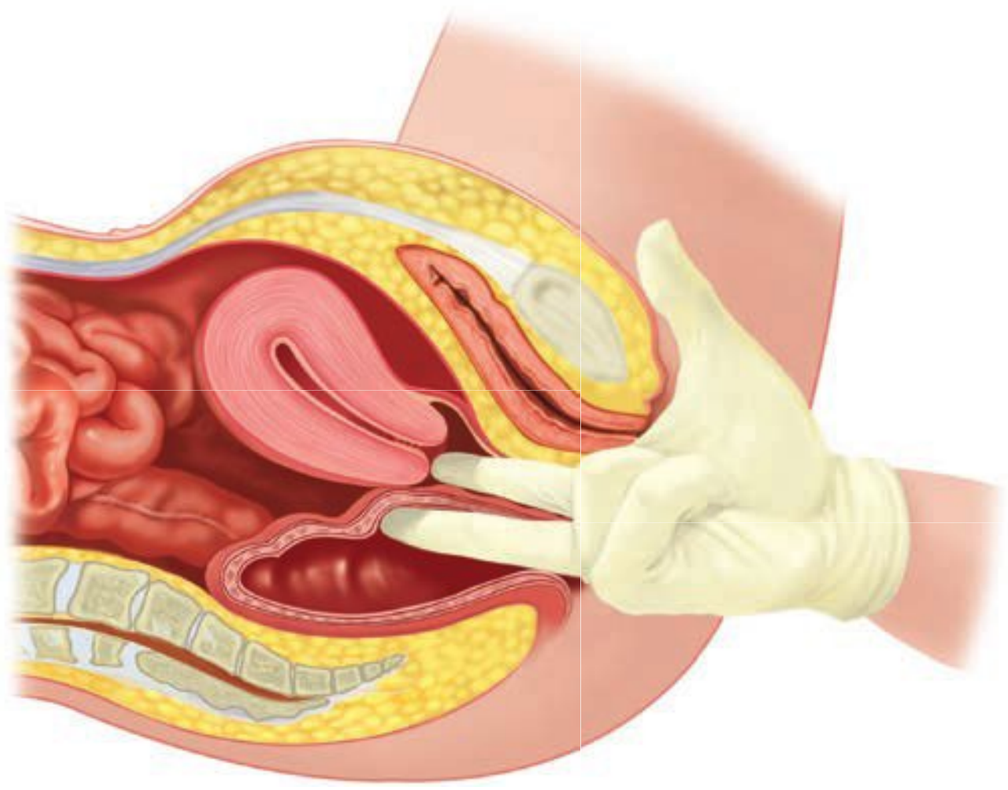


FIGURE 1-9 Rectovaginal examination.

Examination Interval

Periodic health evaluation and screening can prevent or detect numerous medical conditions. Moreover, periodic visits also foster a patient-physician partnership to help guide a woman through adolescence, reproductive years, and past menopause.

An initial reproductive health visit is recommended between ages 13 and 15 years (American College of Obstetricians and Gynecologists, 2014e). This visit initiates a discussion between an adolescent and health-care provider on issues of general reproductive health, puberty, menstruation, contraception, and STD protection. Although not mandated, a pelvic examination may be necessary if gynecologic symptoms are described. Adolescents may prefer to include parents in their gynecologic health care. However, as discussed in Chapter 14 (p. 320), adolescents may seek care for STDs, substance abuse, contraception, or pregnancy without parental permission (American College of Obstetricians and Gynecologists, 2014a).

For women older than 21 years, the American College of Obstetricians and Gynecologists (2014f) recommends annual well woman visits, during which physical and pelvic examinations are completed. Pelvic evaluation contains those components listed on page 4, namely, inspection and speculum, bimanual, and rectal examinations. However, evidence neither supports nor refutes the value of annual pelvic evaluation in asymptomatic women. Thus, exclusion of this portion is a shared decision following patient-provider discussion. Women with gynecologic complaints are encouraged to permit this examination.

One topic in this conversation is cervical cancer screening. For many women, the appropriate screening interval may not be annually, and specific screening methods and schedules are discussed in Chapter 29 (p. 634). Second, in the past, endocervical swabs for gonorrhea and chlamydia infection screening during speculum examination were preferred. Now, such screening can be completed with similar accuracy using nucleic acid amplification testing of urine, vaginal, or endocervical samples.

Other professional organizations have also published statements regarding preventive care visits. The Institute of Medicine (2011) recommends at least one annual well woman visit to obtain preventive services, including preconception and prenatal care. However, investigators from the American College of Physicians (ACP) reviewed pelvic examination benefits and harms in asymptomatic adult women (Qaseem, 2014). These authors describe scarce data to determine the ideal interval for routine pelvic examination. Accordingly, the ACP recommends against screening pelvic examination for asymptomatic, nonpregnant adult women. Thus, again, with each annual visit, a discussion of benefits and risks and an agreement to examination is prudent.

PREVENTIVE CARE

Gynecologists have an opportunity to evaluate their patients for leading causes of female morbidity and mortality and intervene accordingly. Thus, familiarity with various screening guidelines is essential. In 2014, recommendations by the American College of Obstetricians and Gynecologists (2014f) were updated. The USPSTF (2014) regularly revises its screening guidelines, which can be accessed at www.USPreventiveServicesTaskForce.org. These, along with other specialty-specific recommendations, offer valuable guidance for clinicians providing preventive care. Many of these topics are covered in other text chapters. Some remaining important subjects are present in the following sections.

Immunization

The need for new or repeat administration of vaccines should be reviewed periodically. Some vaccines are recommended for all adults, whereas others are indicated because of patient comorbidities or occupational exposure risks. For most healthy adults who have completed the indicated childhood and adolescent immunization schedules, those that warrant consideration are listed in Table 1-2. This table summarizes recommended schedules, precautions, and contraindications for these adult vaccines. As of 2015, a link is provided to the full schedules at: http://www.cdc.gov/vaccines/schedules/.

In general, any vaccine may be coadministered with another type at the same visit. Notably, the influenza vaccine is available in several formulations. Vaccines for human papillomavirus infection prevention, Gardasil and Cervarix, are discussed additionally in Chapter 29 (p. 630).

Cancer Screening

Colon Cancer

In the United States, nearly 64,000 new cases of colorectal cancer are predicted, and this malignancy is the third leading cause of cancer death in women, behind lung and breast cancer (Siegel, 2015). Incidence and mortality rates from this cancer have declined during the past two decades, largely due to improved screening tools. However, adherence to colorectal cancer screening guidelines for women is usually less than 50 percent (Meissner, 2006).

Guidelines recommend screening average-risk patients for colorectal cancer beginning at age 50 with any of the methods shown in Table 1-3 (Smith, 2015). Screening is selected from either of two method categories. The first is capable of identifying both cancer *and* precancerous lesions. The second group of methods primarily detects only cancer and includes the fecal occult blood test, fecal immunochemical test, and stool DNA tests.

Of these, colonoscopy is often the preferred test for colorectal cancer screening. For the patient with average risk and normal findings, testing is repeated in 10 years. In the United States,

TABLE 1-2. Summary of Recommendations for Adult Immunization

Vaccine and Route	Reason to Vaccinate	Vaccine Administration	Contraindications and Precautions[a,b]
Influenza	• All adults	• Yearly • October is ideal, or as long as virus is circulating • Several vaccine types and forms available[c]	**Precaution** • GBS within 6 wk of prior vaccine
Pneumococcal **PCV13** **PPSV23** Give IM or SC	• ≥ 65 yr • Smokers; long-term care residents • Chronic illness; asplenia; immunocompromise	• Age ≥ 65: PCV13, then PPSV23 after 6 months • Smoker aged 19–64: PPSV23 alone • Variant regimens for other indications[d]	
Hepatitis B Give IM	• Adult wishing immunity • Contact risks; travelers to endemic areas[e] • Chronic liver disease; ESRD; HIV; DM	• Three doses: 0, 1, and 4 months	
Hepatitis A Give IM	• Adult wishing immunity • Contact risks; travelers to endemic areas[e] • Chronic liver disease	• Two doses: 0 and 6 months	
Td **Tdap** Give IM	• Adults without prior vaccination • Pregnancy	• Primary series: Td given at 0, 1, and 7 months. If 19–64 yr, one of the three doses is Tdap • Td booster every 10 yr after primary series. If 19–64 yr, a one-time Tdap replaces one of the Td doses • At-risk wounds: booster Td dose if ≥ 5 yr since prior dose • Pregnancy: Tdap dose at 27–36 wk regardless of prior dosing	**Contraindication** • Tdap: encephalopathy after prior vaccine **Precaution** • GBS within 6 wk of prior vaccine • Tdap: unstable neurologic condition
Varicella Give SC	• Adults without immunity	• Two doses: 0 and 1 month • Nonimmune gravida: give postpartum	**Contraindications** • Pregnancy • Immunocompromise **Precaution** • Recent antibody-containing blood products • Hold "-cyclovir" antivirals[f] for 14 days after vaccine
Zoster Give SC	• Those ≥ 60 yr	• One dose	**Contraindications** • Immunocompromise • Pregnancy **Precaution** • Hold "-cyclovir" antivirals[f] for 14 days after vaccine

(Continued)

TABLE 1-2. Summary of Recommendations for Adult Immunization (Continued)

Vaccine and Route	Reason to Vaccinate	Vaccine Administration	Contraindications and Precautions[a,b]
Meningococcal **MCV4** Give IM **MPSV4** Give SC	• Asplenia • Contact risks; travelers to endemic areas[e] • College freshmen	• One dose • Two initial doses for asplenia: 0 and 2 months • Age ≤ 55, use MCV4 • Age ≥ 56, use MPSV4 • Repeat MCV4 every 5 yr if risk persists	
MMR Give SC	• Adults without immunity	• One dose • Nonimmune gravida: give postpartum	**Contraindications** • Immunocompromise • Pregnancy **Precaution** • Prior thrombocytopenia • Recent antibody-containing blood products
HPV Give IM	• All females 11–26 yr	• Three doses: 0, 1, and 6 months	**Precaution** • Pregnancy

[a]Previous anaphylactic reaction to any of a vaccine's components serves as a contraindication for any vaccine.
[b]Moderate to severe illness is a precaution to vaccination. Mild illness is not a contraindication.
[c]Several influenza vaccines are available and listed at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6332a3.htm#Tab.
[d]Full guidelines found at http://www.cdc.gov/vaccines/schedules/downloads/adult/adult-combined-schedule.pdf.
[e]A list is found at http://wwwnc.cdc.gov/travel/yellowbook/2010/table-of-contents.aspx.
[f]These include acyclovir, famciclovir, valacyclovir.
DM = diabetes mellitus; ESRD = end-stage renal disease; GBS = Guillain-Barré syndrome; HIV = human immunodeficiency virus; HPV = human papillomavirus; IM = intramuscular; IV = intravenous; MCV4 = meningococcal conjugate vaccine; MMR = measles, mumps, rubella; MPSV4 = meningococcal polysaccharide vaccine; PCV = pneumococcal conjugate vaccine; PPSV = pneumococcal polysaccharide vaccine; SC = subcutaneous; Td = tetanus, diphtheria; Tdap = tetanus, diphtheria, activated pertussis.
Data from Kim DK, Bridges CB, Harriman HK, et al: Advisory Committee on Immunization Practices recommended immunization schedule for adults aged 19 years or older: United States, 2015. Ann Intern Med 162:214, 2015.

flexible sigmoidoscopy is used less frequently. Its limitations include that only the distal 40 cm of colon are seen, and if lesions are found, then colonoscopy is still needed. A final suitable option—computed tomographic (CT) colonography—is not often covered by insurance plans.

Fecal occult blood testing (gFOBT) is an adequate *annual* screening method when two or three stool samples are self-collected by the patient, and the cards are returned for analysis. This method relies on a chemical oxidation reaction between the heme moiety of blood and alpha guaiaconic acid, a component of guaiac paper. Heme catalyzes the oxidation of alpha guaiaconic acid by hydrogen peroxide, the active component in the developer. This oxidation reaction yields a blue color (Sanford, 2009). Red meat, raw cauliflower, broccoli, members of the radish family, and melons have similar oxidizing ability and may yield false-positive results. Vitamin C may preemptively react with the reagents and lead to false-negative results. All of these are eliminated for 3 days before testing. Additionally, women should avoid nonsteroidal antiinflammatory drugs (NSAIDs) 7 days prior to testing to limit risks of gastric irritation and bleeding. These restrictions are cumbersome for some patients and lead to noncompliance with recommended testing.

Alternatively, the fecal immunochemical test (FIT) relies on an immune reaction to human hemoglobin. Similar to FOBT, the FIT test is performed for annual screening on two or three patient-collected stool samples and does not require pretesting dietary limitations. Advantages to FIT include greater specificity for human blood and thus fewer false-positive results from dietary meat and vegetables and fewer false-negative results due to vitamin C. As another option, screening may be completed with stool DNA (sDNA) testing. One FDA-approved test, Cologuard, screens stool for both DNA and hemoglobin biomarkers that are associated with colorectal cancer (Imperiale, 2014). Positive test results from any of these three warrant further evaluation by colonoscopy.

During patient evaluation of pelvic complaints such as pain, a gynecologist not uncommonly performs gFOBT testing on a single stool sample obtained during digital rectal examination. Although potentially helpful diagnostically, this single stool sample is not considered adequate colorectal cancer screening.

These guidelines are appropriate for those with average risk. High-risk factors include a personal history of colorectal cancer or adenomatous polyps, a first-degree relative with colon cancer or adenomas, chronic inflammatory bowel disease, known or

TABLE 1-3. Screening Guidelines for the Early Detection of Colorectal Cancer and Adenomas for Average-risk Women Aged 50 years and Older

Tests That Detect Adenomatous Polyps and Cancer[a]		
Test	**Interval**	**Key Issues for Informed Decisions**
Colonoscopy	10 years	Bowel prep required; conscious sedation provided
FSIG	5 years	Bowel prep required, sedation usually not provided Positive findings usually merit colonoscopy
Barium enema (DCBE)	5 years	Bowel prep required; polyps ≥ 6 mm merit colonoscopy
Colonography (CTC)	5 years	Bowel prep required; polyps ≥ 6 mm merit colonoscopy
Tests That Primarily Detect Cancer[a]		
Test	**Interval**	**Key Issues for Informed Decisions**
gFOBT	Annually	Two to three stool samples collected at home are needed; a single stool sample gathered during office digital examination is not sufficient screening. Positive results merit colonoscopy
FIT	Annually	Positive results merit colonoscopy
Stool DNA (sDNA)	3 years	Positive results merit colonoscopy

[a]One method from this group is selected.
CTC = Computed tomographic colonography; DCBE = double-contrast barium enema; FIT = fecal immunochemical test; FSIG = flexible sigmoidoscopy; gFOBT = guaiac-based fecal occult blood test; sDNA = stool DNA test.
Adapted with permission from Smith RA, Manassaram-Baptiste D, Brooks D, et al: Cancer screening in the United States, 2015: a review of current American Cancer Society guidelines and current issues in cancer screening. CA Cancer J Clin 2015 Jan-Feb;65(1):30–54.

suspected hereditary syndrome such as hereditary nonpolyposis colon cancer (Lynch syndrome) or familial adenomatous polyposis (Smith, 2015).

Lung Cancer

In the United States, this cancer is estimated to account for 13 percent of all new cancers diagnosed in women in 2015 (Siegel, 2015). It is now the leading cause of cancer-related death in both men and women. All smokers should be advised of tobacco-use risks and encouraged to stop. A list of potential aids is found on page 11.

Lung cancer screening focuses on those at high risk and referral is considered for individuals with general good health, aged 55 to 74, with at least a 30-pack-year history, and who actively smoke or quit within the past 15 years. One remembers that pack-year determination is calculated by multiplying the number of packs smoked per day by the number of years the person has smoked. By convention, one pack contains 20 cigarettes. For appropriate cases, low-dose helical CT scanning is the preferred test (Smith, 2015). Although a common diagnostic test, chest radiography is not recommended as a lung cancer screening tool.

Skin Cancer

The incidence of skin cancers (melanoma and non-melanomas) has increased in the United States during the past three decades. In 2015, melanoma is expected to account for 4 percent of all cancer deaths in women (Siegel, 2015). Skin cancer risks include prolonged sun exposure, family or personal history of skin cancer, fair skin, light hair or freckling, numerous moles, immunosuppression, and aging (American Cancer Society, 2013). The USPSTF notes insufficient evidence to recommend whole body screening by physician or patient for skin cancer in the general adult population (Wolff, 2009). It does advise clinicians to use the "ABCD" system—asymmetry, border irregularity, color, and diameter (> 6 mm) to evaluate skin lesions of concern and refer appropriately.

Lifestyle Changes

Smoking

Cigarette smoking is the single most preventable cause of death in the United States and has been linked with certain cancers, cardiovascular disease, chronic lung diseases, and stroke. Moreover, specific to women's health, smoking is linked to diminished fertility, pregnancy complications, and postoperative complications. These are discussed in greater detail in their respective chapters.

Despite these known negative health outcomes, in 2003, only 64 percent of smokers who had routine examinations in the United States were advised by a physician to quit smoking (Torrijos, 2006). Guidelines from the U.S. Department of Health and Human Services encourage a brief behavioral patient intervention model found on page 12. Patients can also be referred to the National Cancer Institute's smoking cessation website: www.smokefree.gov. This site provides free, evidence-based information and professional assistance to help the immediate and long-term needs of those trying to quit. Unless contraindicated, pharmacologic treatments to aid smoking cessation can be offered to all interested women and

TABLE 1-4. Drugs Used for Smoking Cessation

Agent	Brand Name	Initial Dosing	Maintenance	Drug Tapering	Therapy Duration
Nicotine Replacement					
Patch[d]	Habitrol Nicoderm CQ	If > 10 CPD: a 21-mg patch is reapplied daily wk 1–6 If < 10 CPD: 14-mg patch daily for wk 1–6	14-mg patch is used wk 7–8 —	7-mg patch is used wk 9–10 7-mg patch is used wk 7–8	8–12 wk
Gum[d]	Nicorette 2 mg 4 mg (if ≥ 25 CPD)	1 piece every 1–2 hr for wk 1–6 (maximum 24 pieces/d)	1 piece every 2–4 hr for wk 7–9	1 piece every 4–8 hr for wk 10–12	12 wk
Lozenge[b]	Commit 2 mg 4 mg (if smokes < 30 min after waking)	1 piece every 1–2 hr for wk 1–6 (maximum 20 pieces/d)	1 piece every 2–4 hr for wk 7–9	1 piece every 4–8 hr for wk 10–12	12 wk
Inhaler[d]	Nicotrol		6 (average use) to 16 cartridges puffed qd for 12 wk	Use is then tapered	12–24 wk
Nasal spray[d]	Nicotrol		1 dose = 1 spray to each nostril per hr (maximum 5 doses/hr &40/d)	Use is then tapered starting wk 9	12–24 wk
Nicotine Agonists					
Varenicline[c]	Chantix	0.5 mg PO qd for 3 d, then 0.5 mg PO bid for next 4 d	Then 1 mg PO bid		12 wk
CNS Agents					
Bupropion[c]	Wellbutrin SR Zyban	1–2 wk prior to cessation: 150 mg PO qd for 3 d	Then 150 mg PO bid		7–12 wk; may use for 6 mo.
Nortriptyline[a,d]		25 mg PO qd with gradual increase	75–100 mg PO qd		12 wk; may use for 6 mo.
Clonidine[a,c]	Catapres	0.1 mg PO bid, increase by 0.10 mg/d each wk as needed	0.15–0.75 mg PO qd		3–10 wk
	Catapres-TTS	0.1-mg transdermal patch is changed weekly	0.1- to 0.2-mg transdermal patch weekly		

[a]Recommended as second-line agents by U.S. Public Health Service clinical guidelines, 2008.
[b]Has not been evaluated by the Food and Drug Administration (FDA) for pregnancy.
[c]Considered an FDA pregnancy category C drug.
[d]Considered an FDA pregnancy category D drug.
bid = twice daily; CNS = central nervous system; CPD = cigarettes per day; PO = orally; qd = daily.
Data from Fiore MC, Jaen CR, Baker TB, et al: Treating tobacco use and dependence: 2008 update. Rockville, U.S. Department of Health and Human Services, 2008.

are listed in Table 1-4. Gynecologists who are proficient in the use of these therapies may prescribe. Referral is also appropriate (American College of Obstetricians and Gynecologists, 2014c).

Exercise

Exercise has known benefits in preventing coronary artery disease, diabetes, osteoporosis, obesity, depression, insomnia, and breast and colon cancer (Brosse, 2002; Knowler, 2002; Lee, 2003; Vuori, 2001; Youngstedt, 2005). Many of these associations may result from the effects of exercise to lower blood pressure, decrease low-density lipoprotein cholesterol and triglyceride levels, increase high-density lipoprotein cholesterol levels, improve blood sugar control, and reduce weight (Braith, 2006; Pescatello, 2004; Sigal, 2004).

TABLE 1-5. Definitions of Abnormal Weight for Adults and Adolescents Using Body Mass Index

Age Group	Underweight	Overweight	Obese
Adult	< 18.5	25–29.9	≥ 30
Adolescent	< 5th percentile for age	Between 85th and 95th percentile for age	> 95th percentile for age

Despite these known benefits, based on U.S. government thresholds, only 45 percent of women in 2012 were considered sufficiently active (Blackwell, 2014). Recommendations from the U.S. Department of Health and Human Services (2008) include moderate-intensity activity such as walking, water aerobics, or yard work for at least 150 minutes each week *or* vigorous-intensity activities such as running, swimming laps, or aerobic dancing for 75 minutes each week. Activities can be performed in episodes of at least 10 minutes that are apportioned throughout the week. Additional health benefits are gained with physical activity beyond these amounts.

Although exercise programs have traditionally emphasized dynamic, aerobic lower-extremity exercise, research supports complementary resistance training to improve muscular strength and endurance, cardiovascular function, metabolism, coronary risk factors, weight management, and quality of life (Williams, 2007). Accordingly, government guidelines also encourage biweekly muscle-strengthening activities that involve all the major muscle groups. A fuller listing of general physical activities and their intensity description is found in the publication *2008 Physical Activity Guidelines for Americans* at the CDC website: www.health.gov/paguidelines/guidelines.

To change any type of health-related behavior, counseling can be brief yet effective. One method is the five A's system, which in this example is tailored for exercise (Fiore, 2008).

- Ask: if she is physically active now
- Advise: her about the benefits of regular physical activity
- Assess: her willingness to change and decide if she is in a (1) precontemplation, (2) contemplation phase, (3) preparation, or (4) action phase. Her stage of readiness guides further discussion
- Assist: her by recommending local exercise programs
- Arrange: for follow-up evaluation to assess progress

For those with certain comorbidities, clearance by other health care providers may be indicated. For this, the Physical Activity Readiness Questionnaire helps identify women with risk factors who merit further evaluation and is available at: www.csep.ca/cmfiles/publications/parq/par-q.pdf.

Obesity

Associated Risks and Diagnosis

In 2010, nearly 36 percent of women in the United States were obese, and almost twice that many were overweight (Flegal, 2012). Possible consequences of obesity include diabetes mellitus, metabolic syndrome, nonalcoholic fatty liver, cholelithiasis, hypertension, osteoarthritis, nonobstructive sleep apnea, and renal disease. Gynecologic issues related to obesity include abnormal menstruation, risks for endometrial neoplasia, and worsening polycystic ovary syndrome. Moreover, some hormonal contraceptives may have lower efficacy in obese women. Despite these considerable consequences, one study showed that fewer than half of physicians are comfortable discussing obesity (Schuster, 2008). Even if not trained as weight management specialists, clinicians ideally screen for obesity, provide initial obesity evaluation and management, and refer as needed.

Screening is accomplished with calculation of body mass index (BMI) or less commonly, waist circumference. BMI, although not a direct measure of body fat content, is valuable in assessing the risk for weight-related complications. T e following calculations can be used:

$$\text{BMI} = (\text{Wt in lb}/(\text{Ht in inches} \times \text{Ht in inches})) \times 703$$
$$\text{BMI} = \text{Wt in kg}/(\text{Ht in meters} \times \text{Ht in meters})$$

More simply, an online calculator can be found at: www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/english_bmi_calculator/bmi_calculator.html. For adolescents (and children), BMI is adjusted for age and gender and calculated as a percentile. A BMI calculator for adolescents can be found at http://apps.nccd.cdc.gov/dnpabmi/.calculator.aspx. Table 1-5 ref ects the definitions for underweight, overweight, and obesity for adolescents and adults.

Waist circumference positively correlates with abdominal fat content, which is a risk factor for poor health outcomes. Waist circumference is measured at the level of the iliac crests at the end of normal expiration. Values greater than 35 inches (88 cm) are considered elevated (National Heart, Lung, and Blood Institute, 2000).

No standard single or panel laboratory test is indicated for an obese woman. Evaluation for comorbidities is tailored to the patient, taking into consideration her family and social histories (Table 1-6). Blood pressure measurement, fasting lipid and glucose screening, and thyroid function testing can all be considered for the obese patient during initial evaluation.

TABLE 1-6. Obesity Comorbid Risk Factors

Coronary heart disease (CHD)
Other atherosclerotic disease
Diabetes mellitus
Sleep apnea
Cigarette smoking
Chronic hypertension
Abnormal lipid levels
Family history of early CHD
Gynecologic abnormalities
Abnormal uterine bleeding
Endometrial neoplasia
Osteoarthritis
Gallstones

Data from National Heart, Lung, and Blood Institute: The practical guide: identification, evaluation, and treatment of overweight and obesity in adults. National Institutes of Health Publication No. 98–4084, Bethesda, 2000.

For a woman with elevated BMIs, a clinician should assess her readiness for change and thereby, provide appropriate guidance, support, or referral. In addition, questions regarding previous attempts at weight loss, social hurdles that impede diet and exercise change, and detrimental eating habits are discussed in a nonjudgmental manner.

Treatment

Effective weight loss is best obtained with proper nutrition and consistent physical activity. Table 1-7 illustrates recommended guidelines to direct therapy for overweight or obese women. A detailed discussion of dietary weight loss extends beyond this chapter's scope, but several clinician and patient aids can be found in *T e Practical Guide to Identif cation, Evaluation and Treatment of Overweight or Obesity in Adults*, available at: www.nhlbi.nih.gov/guidelines/obesity/prctgd_c.pdf.

In general, for the adult patient, a 10-percent weight loss within 6 months is realistic. According to the American Heart Association, suitable options are diets with 1200 to 1500 kcal/day or diets that incorporate a 500 or 750-kcal/d deficit (Jensen, 2014). No single diet plan is espoused as the gold standard for every patient, and the ideal regimen is one that can be adhered to.

In addition to diet and exercise, pharmacologic or surgical options may be implemented for selected obese patients. Four agents are FDA-approved for long-term obesity treatment. First, orlistat (Xenical) is a reversible inhibitor of gastric and pancreatic lipases and leads to a 30-percent blockage of dietary fat absorption (Henness, 2006). T is drug is prescribed as 120-mg capsule taken orally three times daily with meals but is also available over-the-counter in 60-mg capsules (Allī), also taken three times daily. Associated malabsorption can lead to deficiencies of the fat-soluble vitamins A, D, E, and K, and all patients should receive a daily supplement enriched with these vitamins. Severe liver injury has been reported rarely, and new labeling ref ects this risk (Food and Drug Administration, 2010).

Another medication, lorcaserin (Belviq) is a serotonin 2C receptor agonist used to suppress appetite (Fidler, 2011; Smith, 2010). One 10-mg tablet is taken orally twice daily. A third agent combines phentermine and topiramate (Qsymia)(Gadde, 2011). Doses begin at 3.75 mg/23 mg orally daily and are gradually titrated upward as needed to a maximum dose of 15 mg/92 mg daily. T is drug has fetotoxicity potential and prescribing providers participate in a Qsymia Risk Evaluation and Mitigation Strategy program. Last, liraglutide (Saxenda) is a glucagon-like peptide-1 receptor agonist delivered by subcutaneous injection (Astrup, 2009). Dosing begins at 0.6 mg daily and is gradually escalated weekly to reach a 3-mg daily dose. Important potential risks include medullary thyroid carcinoma and pancreatitis. T ese last three agents are indicated for those with BMIs of 30 or greater, or 27 or greater if weight-associated comorbid risks exist.

As another adjunct, bariatric surgery may be selected for those with BMIs of 40 or greater, or with BMIs at or above 35 if other comorbid conditions are present (Jensen, 2014). Of available laparoscopic procedures, three are more commonly performed. Two are considered restrictive (limit intake), whereas bypass surgery promotes malabsorptive weight loss. First of these, gastric banding places an adjustable plastic ring around the stomach to limit food intake. Second, sleeve gastrectomy partitions off the lateral stomach by a staple line, and the remaining smaller stomach has a tubular, sleeve appearance. Last, the Roux-en-Y gastric bypass creates a small stomach pouch that is connected directly to the jejunum to bypass the duodenum. T is reduces calorie and nutrient absorption. T ese surgeries lead to substantial weight loss in individuals with morbid obesity and have been linked with improvement in comorbid risk factors and decreased mortality rates (Hutter, 2011). With these, surgical complications are infrequent but can be serious and include gastrointestinal leaks at staple or suture lines, stomal obstruction or stenosis, thromboembolism, and bleeding (Jackson, 2012).

Following bariatric surgery, patients are advised to delay pregnancy for 12 to 24 months (American College of Obstetricians and Gynecologists, 2013). Rapid weight loss during this time poses theoretical risks for intrauterine fetal-growth restriction and nutritional deprivation. However, as weight is lost, fertility rates overall appear to be improved, and risks for pregnancy increase (Merhi, 2009). T us, effective contraception is needed. Most contraceptive methods appear to be as effective in women with elevated BMIs compared with normal-weight controls. However, the contraceptive patch (OrthoEvra) is less effective in those weighing more than 90 kg (Zieman, 2002). Specific to those with malabsorptive bariatric surgery types, oral contraception efficacy may be lower due to poor absorption (Centers for Disease Control and Prevention, 2013). Last, due to its risk for associated weight gain, depot medroxyprogesterone acetate (Depo-Provera) may be an unpopular choice in women trying to lose weight.

Cardiovascular Disease

In 2010, nearly 34 percent of the female population was affected by cardiovascular disease (CVD), and more than 400,000 women died from its complications (Go, 2014). Stratification of CVD predispositions can identify vulnerable patients for management or referral (Table 1-8). Ideal goals for exercise, glucose and lipid levels, blood pressure, and smoking cessation

TABLE 1-7. Treatment Recommendations According to BMI

Treatment	BMI 25–26.9	BMI 27–29.9	BMI 30–34.9	BMI 35–39.9	BMI ≥ 40
Diet, activity, behavioral therapy	WCM	WCM	+	+	+
Pharmacotherapy	—	WCM	+	+	+
Surgery	—	—	—	WCM	+

+ represents the use of indicated treatment regardless of comorbidities; BMI = body mass index; WCM = with comorbidities.
Data from Jensen MD, Ryan DH, Apovian CM, et al: 2013 AHA/ACC/TOS guideline for the management of overweight and obesity in adults: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and The Obesity Society. Circulation 129(25 Suppl 2):S102, 2014.

are discussed in other sections of this chapter. Specific dietary intake recommendations for women are listed in Table 1-9.

Chronic Hypertension

Nearly 41 million American women are hypertensive. The risk of hypertension increases with age and is increased for black women compared with those of other races (Go, 2014). Chronic hypertension increases the risks for myocardial infarction, stroke, congestive heart failure, renal disease, and peripheral vascular disease. Moreover, chronic hypertension and its potential therapies may limit contraception choices for some women. Thus, gynecologists should be familiar with criteria used to diagnose hypertension. Although many may choose to refer their patients for treatment of hypertension, gynecologists should be aware of target goals and long-term risks associated with this disease.

For adult screening, the American Heart Association (2014) recommends blood pressure assessment starting at age 20 and evaluation repeated every 2 years if initially normal. For patients with elevated pressures, assessment is at least annually.

TABLE 1-8. Classification of Cardiovascular Disease (CVD) in Women

≥ 1 assigns high-risk status	Known CHD or CVD Peripheral arterial disease Aortic aneurysm End-stage renal disease Diabetes mellitus
≥ 1 assigns at-risk status	Smoking SBP ≥ 120 or DBP ≥ 80 mm Hg, or treated hypertension Total cholesterol ≥ 200 mg/dL, HDL < 50 mg/dL, or treated dyslipidemia Obesity Poor diet Physical inactivity Family history of premature CVD Metabolic syndrome Collagen-vascular disease Prior PIH or gestational DM
Ideal, if all present	Total cholesterol < 200 mg/dL BP < 120/< 80 mm Hg Fasting blood glucose < 100 mg/dL Body mass index < 25 Abstinence from smoking Physically activity Healthy diet: see Table 1-9

BP = Blood pressure; CHD = coronary heart disease; CVD = cardiovascular disease; DBP = diastolic blood pressure; DM = diabetes mellitus; GDM = gestational diabetes; HDL = high-density lipoprotein; PIH = pregnancy-induced hypertension; SBP = systolic blood pressure.
Adapted with permission from Mosca L, Benjamin EJ, Berra K, et al: Effectiveness-based guidelines for prevention of cardiovascular disease in women—2011 update: a guideline from the american heart association, Circulation 2011 Mar 22;123(11):1243–1262.

TABLE 1-9. Specific Dietary Intake Recommendations for Women

Food	Serving
Fruits/vegetables	≥ 4.5 cups/d
Fish	2/wk
Fiber	30 g/d
Whole grains	3/d
Sugar	≤ 5/wk
Nuts, legumes	≥ 4/wk
Saturated fat	< 7%/total energy intake
Cholesterol	< 150 mg/d
Alcohol	≤ 1/d
Sodium	< 1500 mg/d
trans-Fatty acids	None

Adapted with permission from Mosca L, Benjamin EJ, Berra K, et al: Effectiveness-based guidelines for prevention of cardiovascular disease in women—2011 update: a guideline from the american heart association, Circulation 2011 Mar 22;123(11):1243–1262.

With screening, blood pressures are best taken with a woman seated in a chair with the tested arm resting on a table, at the level of the heart. Ideally, the patient has been able to rest quietly for a few minutes prior to measurement and to have refrained from tobacco and caffeine use immediately prior to testing. An appropriately sized cuff is selected, and the cuff bladder should encircle at least 80 percent of the arm. Hypertension is diagnosed if readings are elevated on at least two separate office visits over one or more weeks. *Prehypertension* is diagnosed if readings fall in the range 130–139/80–89 mm Hg. Notably, women with prehypertension are at significantly increased risk of developing hypertension later (Wang, 2004). Additionally, compared with normal blood pressure readings, prehypertension is associated with greater risks for CVD (Mainous, 2004).

If hypertension is diagnosed, further examination should exclude underlying causes of hypertension and resultant end-organ disease (Table 1-10). With the diagnosis of chronic hypertension, assessment then follows for both modifiable and nonmodifiable CVD risk factors. Thus, routine laboratory tests recommended before initiating therapy include an electrocardiogram, urinalysis, blood glucose, hematocrit, lipid profile, thyroid testing, and serum potassium and creatinine measurement. A more extensive search for identifiable causes is not generally indicated unless hypertension is not controlled with initial treatment (Chobanian, 2003).

For treatment, lifestyle changes that mirror those for CVD are encouraged (see Table 1-9). However, if blood pressure is significantly elevated or resistant to lifestyle modification alone, then pharmacologic treatment may be needed to decrease long-term complications. Recommendations from the Eighth Joint National Committee (JNC 8) are shown in Table 1-11 (James, 2014).

Stroke

This is the third leading cause of death in the United States, and in 2010, approximately 425,000 American women suffered a new or recurrent stroke (Go, 2014). Gender-specific risk factors for stroke in women include hypertension, atrial fibrillation, migraines with aura, and oral contraceptive use. Aspirin is recommended

TABLE 1-10. Identifiable Causes of Hypertension

Chronic renal disease
Chronic corticosteroid therapy and Cushing syndrome
Coarctation of the aorta
Drug-induced or drug-related
Nonsteroidal antiinflammatory drugs
Cocaine and amphetamines
Sympathomimetics (decongestants, anorectics)
Combination hormonal contraception
Adrenal steroids
Cyclosporine and tacrolimus
Erythropoietin
Licorice
Herbal medicines (ephedra, ma huang)
Pheochromocytoma
Primary aldosteronism
Renovascular disease
Sleep apnea
Thyroid or parathyroid disease

as prevention for stroke in normotensive women aged 65 years or older for whom the lowered risks for ischemic stroke and myocardial infarction outweigh the risks for gastrointestinal bleeding and hemorrhagic stroke (Bushnell, 2014). There is no consensus as to the optimal dose or frequency of aspirin for prevention. Options are 81 mg daily or 100 mg every other day.

Dyslipidemia

Hypercholesterolemia

Data support that low-density lipoprotein cholesterol (LDL) is the primary atherogenic agent. Although previously believed merely to collect passively within vessel walls, LDL is now felt to be a potent proinflammatory agent and creates the chronic inflammatory response characteristic of atherosclerosis. Logically, elevated levels of total and LDL cholesterol are associated with increased rates of coronary artery disease, ischemic stroke, and other atherosclerotic vascular complications (Horenstein, 2002; Law, 1994).

Preventively, the National Cholesterol Education Program Adult Treatment Panel-III (ATP-III) (2001) recommends that all adults 20 years and older be screened with a fasting serum lipoprotein profile once every 5 years. This profile includes measurement of total, LDL, and high-density lipoprotein (HDL) cholesterol levels and triglyceride concentrations. Table 1-12 lists interpretation of these levels. Notably, if other comorbid risks for coronary heart disease are present, then LDL goals are more stringent.

TABLE 1-12. Interpretation of Cholesterol and Triglyceride Levels

Lipoprotein (mg/dL)	Interpretation
Total cholesterol	
< 200	Optimal
200–239	Borderline elevated
≥ 240	Elevated
LDL cholesterol	
< 100	Optimal
100–129	Near optimal
130–159	Borderline elevated
160–189	Elevated
≥ 190	Very elevated
HDL cholesterol	
< 40	Low
≥ 60	Elevated
Triglycerides	
< 150	Optimal
150–199	Borderline elevated
200–499	Elevated
≥ 500	Very elevated

HDL= high-density lipoprotein; LDL= low-density-lipoprotein.
Data from National Cholesterol Education Program: Detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel III). National Institutes of Health Publication No.01–3670, Bethesda, 2001.

Lowering LDL levels has been associated with reduced rates of myocardial infarction and stroke (Goldstein, 2006; Sever, 2003). Initial management usually begins with lifestyle and dietary changes, discussed earlier for CVD, and outlined by the American Heart Association (Eckel, 2014). If these modifications are unsuccessful, this organization recommends lipid-lowering treatment consideration for: (1) those with known CVD, (2) those with LDL cholesterol levels at or above 190 mg/dL, (3) those aged 40 to 75 years with diabetes and LDL cholesterol levels of 70 mg/dL or more, and (4) those

TABLE 1-11. Initial Drug Therapy for Adults with Hypertension

Health Status	Goal BP	Treatment
General ≥ 60 yr	< 150/90	Nonblack: thiazide-type diuretic, ACEI, ARB, or CCB Black: thiazide-type diuretic or CCB
General < 60 yr	< 140/90	
Diabetes	< 140/90	
Renal disease	< 140/90	ACEI or ARB

ACEI= angiotensin-converting enzyme inhibitor; ARB= angiotensin-receptor blocker; BP= blood pressure; CCB= calcium-channel blocker.
Data from James PA, Oparil S, Carter BL, et al: 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). JAMA 311(5):507, 2014.

aged 40 to 75 years with LDL cholesterol levels of 70 mg/dL or higher and an estimated 10-year risk of a cardiovascular event that is at least 7.5 percent (Stone, 2014).

Hypertriglyceridemia

Triglycerides are delivered to tissues by very-low-density lipoprotein (VLDL), which is synthesized and secreted by the liver. T is triglyceride-rich lipoprotein is taken up by adipose and muscle, where triglycerides are cleaved from VLDL. Ultimately, a VLDL remnant is created that is atherogenic. For this reason, triglyceride levels can be used as one marker for atherogenic lipoproteins, and high triglyceride levels have been linked to increases in CVD (Assmann, 1996; Austin, 1998). Its clinical importance is also underscored by its inclusion as one criterion for the metabolic syndrome.

Hypertriglyceridemia is diagnosed based on criteria found in Table 1-12. For most with mild or moderate triglyceride elevation, recommendations from American Heart Association emphasize diet changes and weight loss (Miller, 2011). Alternatively, for those with triglyceride levels of 500 mg/dL or greater, treatment goals focus primarily on triglyceride level lowering to prevent pancreatitis.

Diabetes Mellitus

Diabetes is common, and approximately 13.4 million adult women in the United States are diabetic (Centers for Disease Control and Prevention, 2014). T e long-term consequences of this endocrine disorder are serious and include coronary heart disease, stroke, peripheral vascular disease, periodontal disease, nephropathy, neuropathy, and retinopathy.

T e USPSTF (2014b) recommends diabetes screening for asymptomatic adults with blood pressure of 135/80 mm Hg or greater. For normotensive adults, screening is individualized based on risks. However, the American Diabetes Association (2015) recommends that screening be considered at 3-year intervals beginning at age 45, particularly in those with BMIs of 25 or above. Moreover, testing is considered at a younger age or completed more often in those who are overweight and have one or more of the other risk factors shown in Table 1-13.

Diabetes and prediabetes may be diagnosed by various laboratory tests listed in Table 1-14. Laboratory measurement of plasma glucose concentration is performed on venous samples, and the aforementioned values are based on the use of such methods. Capillary blood glucose testing using a blood glucometer is an effective monitoring tool but is not currently recommended for diagnostic use.

For those diagnosed with diabetes, referral to a specialist is usually indicated. Delayed onset and slower progression of many diabetic complications has been shown to follow control of elevated blood glucose levels (Cleary, 2006; Fioretto, 2006; Martin, 2006). Control can be achieved with diet modification alone or combined with oral hypoglycemic agents or injectable insulin. To lower diabetic morbidity, therapy goals for otherwise normal patients include hemoglobin A_{1c} levels below 7 percent, preprandial glucose between 80 and 130 mg/dL, blood pressure readings below 120/80 mm Hg, low-density lipoprotein (LDL) levels below 100 mg/dL, HDL levels above 50 mg/dL, triglyceride levels below 150 mg/dL, weight loss, and smoking cessation (American Diabetes Association, 2015).

TABLE 1-13. Adult Risk Factors for Diabetes Mellitus

Age ≥ 45 years
Body mass index ≥ 25
Affected first-degree relative
Physical inactivity
Ethnicity: African-, Hispanic-, Native-, and Asian-Americans; Pacific Islanders
Prior prediabetes-range test values
Prior gestational diabetes mellitus or delivery of a baby weighing > 9 lb
Hypertension: ≥ 140/90 mm Hg
HDL cholesterol ≤ 35 mg/dL and/or triglyceride level ≥ 250 mg/dL
Polycystic ovary syndrome
Conditions associated with insulin resistance
Existing cardiovascular disease

HDL = high-density lipoprotein.
Data from American Diabetes Association, 2015 American Diabetes Association: Standards of medical care in diabetes—2015. Diabetes Care 38:S1, 2015.

Patients with "prediabetes," that is, impaired fasting glucose or impaired glucose tolerance, have an increased risk for developing diabetes. To avert or delay diabetes, management includes increased physical activity, weight loss, drugs such as metformin, nutritional counseling, and yearly diabetes screening. Metformin is considered especially for those with BMI above 35, age younger than 60 years, and prior gestational diabetes (American Diabetes Associations, 2015).

TABLE 1-14. American Diabetes Association Criteria

Diagnostic Criteria for Diabetes Mellitus
HbA_{1C} ≥ 6.5%
or
Fasting plasma glucose ≥ 126 mg/dL. Fasting is no caloric intake for at least 8 hr
or
2-hr plasma glucose ≥ 200 mg/dL during an OGTT
or
Symptoms of diabetes plus random plasma glucose concentration ≥ 200 mg/dL. Classic symptoms of diabetes include polyuria, polydipsia, and unexplained weight loss
Criteria for Increased Diabetes Risk (prediabetes)
Fasting plasma glucose: 100–125 mg/dL
or
2-hr plasma glucose during 75-g OGTT: 140–199 mg/dL
or
HbA_{1C}: 5.7–6.4%

HbA_{1c} = hemoglobin A_{1c}; OGTT = oral glucose tolerance test.
Data from American Diabetes Association: Diagnosis and classification of diabetes mellitus, Diabetes Care. 2008 Jan;31 Suppl 1:S55–S60.

TABLE 1-15. Diagnostic Criteria for Metabolic Syndrome in Women

Criteria	Thresholds
Waist circumference	≥ 88 cm (≥ 35 in)
Triglycerides	≥ 150 mg/dL
HDL cholesterol	< 50 mg/dL
Blood pressure	≥ 130/85 mm Hg
Fasting glucose	≥ 110 mg/dL

Drug treatment for any of these conditions is considered a positive criterion.
HDL = high-density lipoprotein.
Adapted with permission from Grundy SM, Cleeman JI, Daniels SR, et al: Diagnosis and management of the metabolic syndrome: an American Heart Association/National Heart, Lung, and Blood Institute scientific statement, Circulation 2005 Oct 25;112(17):2735–2752.

Metabolic Syndrome

This syndrome is a clustering of major cardiovascular disease risk factors (Table 1-15). At present, a single unifying cause of the metabolic syndrome has not been identified, and it may be precipitated by multiple underlying risk factors. Of these, abdominal obesity and insulin resistance appear important (Grundy, 2005).

This syndrome is common, and in 2010, 22 percent of U.S. women met diagnostic criteria. Although genders appear equally affected, Mexican Americans show the highest prevalence, and incidence appears to increase in all ethnicities with age (Beltrán-Sánchez, 2014). The sequelae associated with metabolic syndrome are significant and include an increased risk of diabetes and mortality from coronary heart disease, CVD, and all causes (Lorenzo, 2003; Malik, 2004; Sattar, 2003). Among those with metabolic syndrome, risks are further increased, by cigarette smoking and elevated LDL cholesterol levels.

Goals of clinical management include reducing risks for clinical atherosclerotic disease and for diabetes. Accordingly, primary therapy for metabolic syndrome focuses on lifestyle modification, particularly weight reduction and increased exercise. During evaluation, each metabolic syndrome component is addressed and treated in accordance with current guidelines, as discussed in earlier sections.

Thyroid Disease

The risk of thyroid disease increases with age, and dysfunction is more common in women. Accordingly, the American Thyroid Association recommends that adults, especially women, be screened for thyroid dysfunction by measurement of a serum thyroid-stimulating hormone (TSH) concentration. This is begins at age 35 years and is repeated every 5 years thereafter (Garber, 2012). Moreover, individuals with clinical manifestations potentially attributable to thyroid dysfunction and those with risk factors for its development may require more frequent testing. People at higher risk for thyroid dysfunction include the elderly and those with prior neck radiation, thyroid surgery, autoimmune disease, affected first-degree relative, psychiatric disorders, or lithium use. In contrast, the U.S. Preventive Service Task Force (2004b) has found insufficient evidence to recommend for or against routine screening in asymptomatic women.

Geriatric Screening

Women are now living longer, and the current life expectancy for women in the United States is 81 years (Arias, 2014). As a woman moves past menopause, many of her health care needs may not be gynecologic. However, a family may often contact a patient's gynecologist first regarding a member's lack of independent function or memory loss.

Of these, functional status is a patient's ability to perform both basic and complex activities for independent living. Basic activities are grooming and toileting, whereas checkbook balancing, bill paying, and housekeeping tasks are more complex, instrumental activities of daily living (Katz, 1963; Lawton, 1969). Declines in functional status are linked to increased risks of hospitalization, institutionalization, and death (Walston, 2006). Identification of functional status loss may permit early intervention.

Second, loss of cognitive function may present as short- and long-term memory loss, difficulty with problem solving, or inattention to personal hygiene. Although not expert in recognition of cognitive problems, a gynecologist can perform initial screening and provide results that either reassure the patient and her family or prompt more formal evaluation by a geriatrician or neurologist.

For dementia, the Mini Mental Status Exam or, more recently, the Mini-Cog Test can screen for cognitive impairment in the primary care setting (Borson, 2000, 2006; Folstein, 1975). The Mini-Cog test requires approximately 3 minutes to administer and begins by giving the patient three items to remember early in the interview. Later in discussion, she is asked to recall those three items. For the clock-drawing test, a person is asked to draw a clock with the hands at a specific time, such as 8:30. A correct clock has numbers 1 through 12 labeled correctly in a clockwise fashion, with two arms (of any length) pointing at the correct numbers for the time requested. Any error or refusal to complete the clock is considered abnormal. An algorithm for scoring the Mini-Cog is shown in Figure 1-10. For a Mini-Cog Test result suggestive of dementia, referral to an internist, geriatrician, or neurologist, as available to the patient in that community, is indicated.

Mental Health

Depression and Intimate Partner Violence

For women of all ages, these problems are pervasive and account for significant morbidity and mortality. Each is discussed in

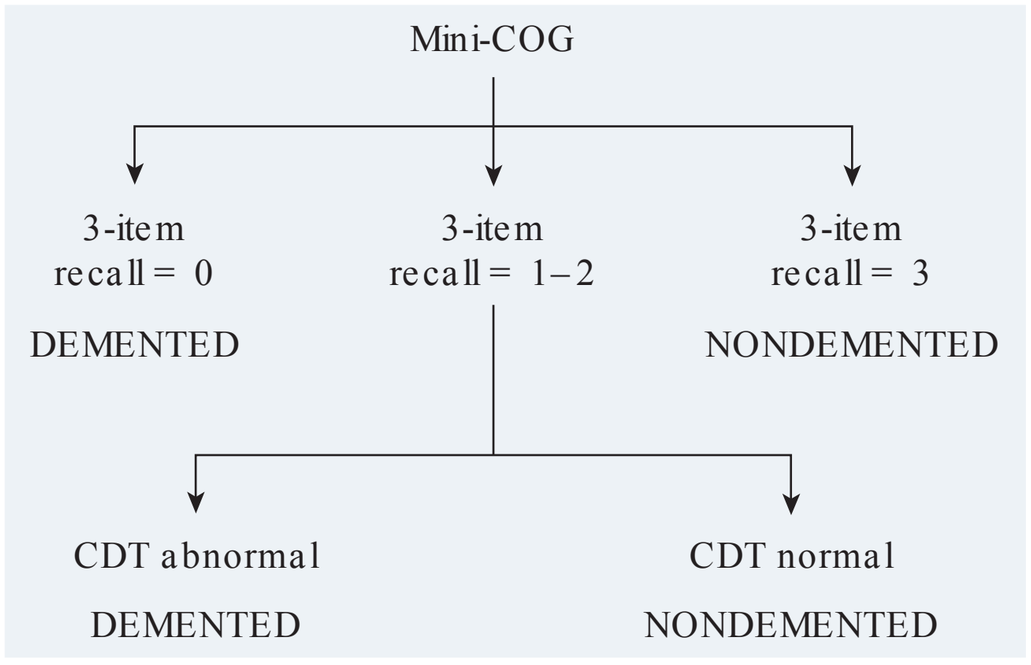


FIGURE 1-10 The Mini-Cog Test. CDT = clock-drawing test. (Modified with permission from Borson S, Scanlan J, Brush M, et al: The Mini-Cog: a cognitive "vital signs" measure for dementia screening in multi-lingual elderly. Int J Geriatr Psychiatry 2000 Nov;15(11):1021–1027.)

detail in Chapter 13 and should be routinely screened for at routine health visits. Simple questions such as "During the past 2 weeks, have you felt down, depressed, or hopeless?" and "Have you felt little interest or pleasure in doing things?" are often effective (Whooley, 1997). These two questions constitute the Personal Health Questionnaire-2 (PHQ2), a validated screening tool for depression (Kroenke, 2003). Any positive screening test should prompt further evaluation for depression as outlined in Chapter 13 (p. 298).

For intimate partner violence, American College of Obstetricians and Gynecologists (2012a) guidelines recommend that physicians routinely ask direct, specific questions regarding abuse. General introductory statements such as "Because abuse and violence are so common in women's lives, I've begun to ask about it routinely" can help a health care provider introduce this subject for discussion.

Insomnia

Insomnia is common, and its definition includes: (1) difficulty initiating sleep, (2) trouble maintaining sleep, and (3) early waking. Insomnia may be primary or may be secondary to other conditions such as depression, time-zone travel, restless leg syndrome, stimulant use, and sleep apnea (National Institutes of Health, 2005). Accordingly, historical inventory investigates and treatment addresses these and other secondary causes.

Treatment of primary insomnia is typically cognitive-behavioral or pharmacologic. Cognitive therapy is aimed at changing patients' beliefs and attitudes regarding sleep. Behavioral therapies are varied and include those that control sleep timing and duration; attempt to improve the bedroom environment; or focus on relaxation or biofeedback techniques (Morgenthaler, 2006; Silber, 2005). Medications may be used to aid sleep, and most agents are of the benzodiazepine family (Table 1-16).

TABLE 1-16. Insomnia Medications Approved by the U.S. Food and Drug Administration

Medication: Brand	Dose
Benzodiazepines	
Temazepam: Restoril	7.5–30 mg
Estazolam: ProSom	0.5–2 mg
Triazolam: Halcion	0.125–0.25 mg
Flurazepam: Dalmane	15–30 mg
Quazepam: Doral	7.5–15 mg
Benzodiazepine-Receptor Agonists	
Eszopiclone: Lunesta	1–3 mg
Zolpidem: Ambien,	5–10 mg
Ambien CR[a]	6.25–12.5 mg
Intermezzo[b]	1.75 mg
Zaleplon: Sonata	5–20 mg
Melatonin-Receptor Agonist	
Ramelteon: Rozerem	8 mg

[a]Extended release form.
[b]Indicated for middle-of-night awakening.

Preconceptional Counseling

Value lies in counseling women before conception so that each pregnancy is planned with the goal to achieve the best maternal and fetal outcomes. With this in mind, topics found in Table 1-17 are ideally addressed (American College of Obstetricians and Gynecologists, 2012b; Jack, 2008).

TABLE 1-17. Preconceptional Counseling Topics

Condition	Recommendations for Preconceptional Counseling
Abnormal weight	Calculate BMI yearly. BMI ≥ 25 kg/m^2: Counsel on diet. Test for DM and metabolic syndrome if indicated BMI ≤ 18.5 kg/m^2: Assess for eating disorder
Heart disease	Counsel on cardiac risks during pregnancy. Optimize cardiac function, offer effective BCM during this time. Discuss warfarin, ACE inhibitor, and ARB teratogenicity, and if possible, switch to less dangerous agent when conception planned. Offer genetic counseling to those with congenital cardiac anomalies. Review infective endocarditis risks (Nishimura, 2014)
Hypertension	Counsel on specific risks during pregnancy. Assess those with long-standing HTN for ventricular hypertrophy, retinopathy, and renal disease. Counsel women taking ACE inhibitors and ARBs on drug teratogenicity, on effective BCM during use, and on the need to switch agents prior to conception
Asthma	Counsel on asthma risks during pregnancy. Optimize pulmonary function and offer effective BCM during this time. Treat women with pharmacological step therapy for chronic asthma based on ACOG-ACAAI (2000) recommendations
Thrombophilia	Question for personal or family history of thrombotic events or recurrent poor pregnancy outcomes. If found, counsel and screen those contemplating pregnancy. Offer genetic counseling to those with known thrombophilia. Discuss warfarin teratogenicity, offer effective BCM during use, and switch to a less teratogenic agent, if possible, prior to conception

(Continued)

TABLE 1-17. Preconceptional Counseling Topics (Continued)

Condition	Recommendations for Preconceptional Counseling
Renal disease	Counsel on specific risks during pregnancy. Optimize blood pressure control and offer effective BCM during this time. Counsel women taking ACE inhibitors and ARBs on their teratogenicity, on effective BCM during use, and on the need to switch agents prior to conception
GI disease	Inflammatory bowel disease: Counsel affected women on subfertility risks and risks of adverse pregnancy outcomes. Discuss teratogenicity of MTX and the other immunomodulators, about which less is known, e.g., mycophenolate mofetil. Offer effective BCM during their use and switch agents, if possible, prior to conception
Liver disease	Hepatitis B: Vaccinate all high-risk women prior to conception (Table 1-2, p. 8). Counsel chronic carriers on transmission prevention to partners and fetus Hepatitis C: Screen high-risk women. Counsel affected women on risks of disease and transmission. Refer for treatment, discuss ramifications of treatment during pregnancy, and offer effective BCM
Hematologic disease	Sickle-cell disease: Screen all black women. Counsel those with trait or disease. Test partner if desired Thalassemias: Screen women of Southeast Asian or Mediterranean ancestry
Diabetes	Advocate good glucose control, especially in periconceptional period to decrease known teratogenicity of overt diabetes. Evaluate for retinopathy, nephropathy, hypertension, etc.
Thyroid disease	Screen those with thyroid disease symptoms. Ensure iodine-sufficient diet. Treat overt hyper- or hypothyroidism prior to conception. Counsel on risks to pregnancy outcome
CT disease	RA: Counsel on flare risk after pregnancy. Discuss MTX and leflunomide teratogenicity. Offer effective BCM during their use and switch agents prior to conception. SLE: Counsel on risks during pregnancy. Optimize disease. Discuss mycophenolate mofetil and cyclophosphamide teratogenicity; offer effective BCM during their use. If possible, switch agents prior to conception
Neurologic and psychiatric disorders	Depression: Screen for symptoms. If affected, counsel on risks of treatment and of untreated illness and high risk of peripartum exacerbation Seizure disorder: Optimize seizure control using monotherapy if possible
Skin disease	Discuss isotretinoin and etretinate teratogenicity, offer effective BCM during their use, switch agents prior to conception
Cancer	Counsel on fertility preservation options prior to cancer therapy and on decreased fertility following certain agents. Offer genetic counseling to those with mutation-linked cancers. Evaluate cardiac function in those given cardiotoxic agents, such as adriamycin. Obtain mammography for those given childhood chest radiotherapy. Discuss SERM teratogenicity, effective BCM during its use, and need to switch agents prior to conception. Review chemotherapy and discuss possible teratogenic effects if continued during pregnancy
Infectious disease	Influenza: Vaccinate all women prior to flu season Malaria: Avoid travel to endemic areas; offer effective BCM or chemoprophylaxis for those planning pregnancy Rubella: Assess immunity; vaccinate as needed and offer effective BCM during next 3 months Tuberculosis: Screen high-risk women and treat Tetanus: Update vaccination, as needed Varicella: Assess immunity; vaccinate as needed and offer effective BCM during next 3 months
STD	Gonorrhea, syphilis, chlamydial infection: Screen per Table 1-1 (p. 6) and treat as indicated HIV: Discuss initiation of treatment prior to conception to decrease perinatal transmission. Offer effective BCM to those not desiring conception HPV: Provide screening per guidelines (Chap. 29, p. 629). Vaccinate as indicated HSV: Provide serological screening to asymptomatic women with affected partners. Counsel affected women on risks of perinatal transmission and of preventive measures during the third trimester and labor

ACAAI = American College of Allergy, Asthma, and Immunology; ACE = angiotensin-converting enzyme; ACOG = American College of Obstetricians and Gynecologists; BCM = birth control method; ARB = angiotensin-receptor blocker; BMI = body mass index; HIV = human immunodeficiency virus; HPV = human papillomavirus; HSV = herpes simplex virus; HTN = hypertension; MTX = methotrexate; NSAID = nonsteroidal antiinflammatory drug; RA = rheumatoid arthritis; SERM = selective estrogen-receptor modulator; SLE = systemic lupus erythematosus; STD = sexually transmitted disease.
Data from American College of Obstetricians and Gynecologist, 2012b; Jack, 2008; Kim, 2015.

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CHAPTER 2

Techniques Used for Imaging in Gynecology

Several technical advances made in recent decades currently allow superb imaging of female pelvic structures. As a result, use of sonography in gynecology now equals that in obstetrics. Enhancements to traditional sonography continue to fill important clinical gaps. For example, three-dimensional (3-D) imaging refinements have expanded the gynecologic indications of sonography to rival those of computed tomography (CT) and magnetic resonance (MR) imaging for many conditions. Similarly, application of MR imaging has been extended by MR-guided high-intensity focused ultrasound therapy, used for uterine leiomyoma treatment.

SONOGRAPHY

Physics

In sonography, the picture displayed on a screen is produced by sound waves reflected back from an imaged structure. To begin, alternating current is applied to a transducer containing piezoelectric crystals, which convert electric energy to high-frequency sound waves. A water-soluble gel applied to the skin acts as a coupling agent. Sound waves then pass through tissue layers, encounter an interface between tissues of different densities, and are reflected back to the transducer. Converted back into electric energy, they are displayed on a screen.

Dense material, such as bone, or a synthetic material, such as an intrauterine device (IUD), produces high-velocity reflected waves, also termed *echoes*, which are displayed on a screen as white. T ese are described as *echogenic*. Conversely, fluid is *anechoic*, generates few reflected waves, and appears black on a screen. Middle-density tissues variably reflect waves to create various shades of gray, and images are described as *hypoechoic* or *hyperechoic* relative to tissues immediately adjacent to them. Images are generated so quickly—50 to 100 frames/sec—that the picture on the screen appears to move in real time.

Sound reflection is greatest when the difference between the acoustic impedance of two structures is large. T is explains why cysts are so well demonstrated with sonography. Strong echoes are produced from the cyst walls, but no echoes arise from the cyst fluid. As more sound traverses the cyst, more echoes are received from the area behind the cyst, a feature known as *through transmission* or *acoustic enhancement* (Fig. 2-1). In contrast, with a dense structure, the sound passing through it is diminished, which creates a band of reduced echoes beyond it, known as *acoustic shadowing* (Fig. 2-2).

T e frequency of emitted ultrasound waves is expressed in megahertz (MHz), which means million vibrations per second. T e frequency is inversely related to its wavelength, such that transducers emitting pulses of high frequency generate waves of shorter length, which result in higher spatial resolution or sharpness between interfaces but achieve less penetration. Curved transducers provide a wider field of view but often generate lower frequency waves than linear transducers. Higher frequency probes (10 to 15 MHz) are used to image superficial structures, such as breast masses or lost etonogestrel implants in the upper arm. Lower frequencies are required to image deeper structures. For example, transabdominal transducers are typically in the 3- to 5-MHz range, whereas transvaginal transducers are generally 5 to 10 MHz.

Examination Techniques

Guidelines for sonographic examination of the female pelvis have been established by T e American Institute of Ultrasound in Medicine (2014). T ese serve as quality assurance standards for patient care and provide assistance to practitioners performing sonography. Guidelines describe equipment and documentation and may be accessed at: http://www.aium.org/resources/guidelines/femalepelvis.pdf.

All probes are cleaned after each examination, and vaginal probes are covered by a protective sheath prior to insertion. A female staff member should always chaperone transvaginal sonography. Guidelines describe the examination steps for each organ and anatomic region in the female pelvis. For instance, for the uterus: uterine size, shape, orientation, and description of the endometrium, myometrium, and cervix are documented. T e examination and its interpretation are permanently recorded,

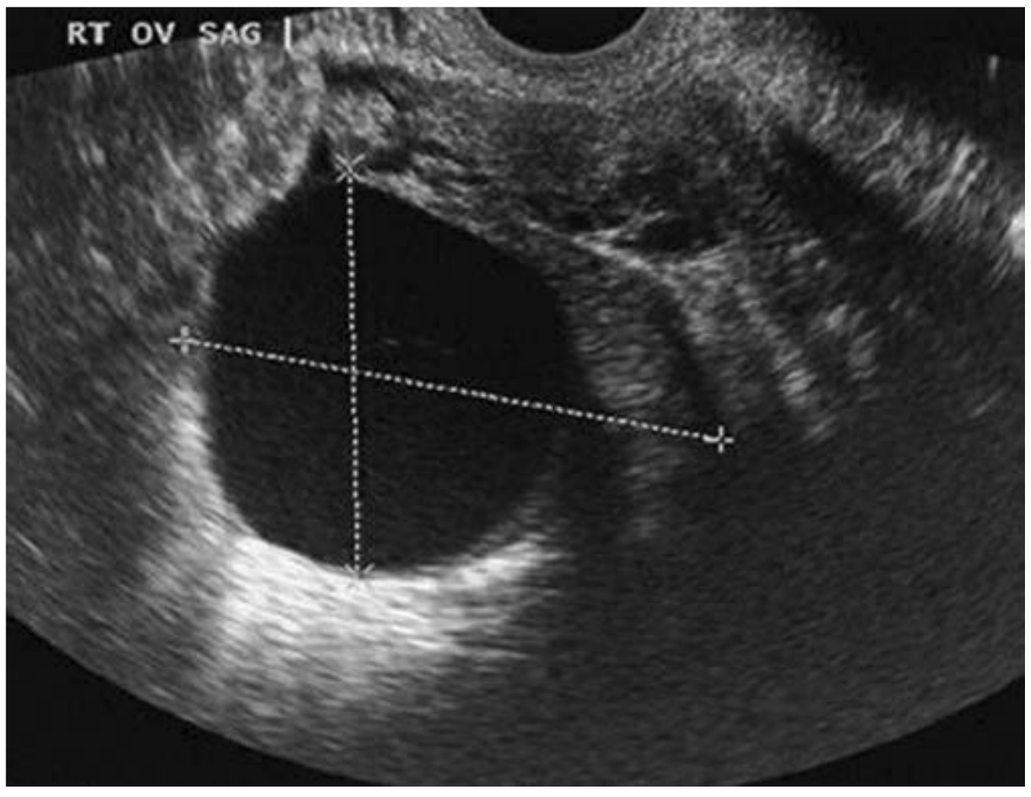


FIGURE 2-1 Transvaginal sonogram of a premenopausal ovary containing a follicular cyst. The cyst fluid appears black or anechoic. Note the white or hyperechoic area under the cyst, a sonographic feature called posterior acoustic enhancement or through transmission.

appropriately labeled, and placed in the medical record. A copy is also kept by the facility performing the study.

Gray-scale Imaging

Various examination techniques can be used for sonographic study of the female pelvis. Of these, transabdominal evaluation, using a curved-array 3- to 5-MHz transducer, is the first component of general gynecologic examinations because it provides global identification of all pelvic organs and their spatial relationships (American Institute of Ultrasound in Medicine, 2014). In a nonpregnant patient, a full bladder is preferred for adequate viewing, as it pushes the uterus upward from behind the pubic symphysis and displaces small bowel from the field of view. Moreover, the bladder acts as an *acoustic window*, to improve ultrasound wave transmission. In patients with large lesions or masses located superior to the bladder dome, transabdominal sonography provides a panoramic view for greater disease evaluation. Still, endometrial cavity assessment is limited with a transabdominal approach and often requires the transvaginal technique.

Transvaginal sonography (TVS) uses higher-frequency (5- to 10-MHz) transducers and is the second component of general gynecologic examinations. Because of its increased sensitivity and spatial image resolution, TVS is ideal for interrogating pelvic anatomy within the confines of the true pelvis. With larger masses, imaging may be incomplete and is complemented by transabdominal sonography.

For TVS, the probe is positioned in the vaginal fornices to place the transducer close to the region of interest and thereby lessen beam attenuation within superficial soft tissues. In contrast to transabdominal imaging, the bladder is emptied prior to a transvaginal study. TVS has few limitations. T e only two absolute contraindications are imperforate hymen and patient refusal. A relative contraindication is a patient with a virginal or strictured introitus. T ese women, however, can usually undergo comfortable examination with proper counseling.

Transrectal and transperineal techniques employ transrectal probes and conventional transducers placed over the perineal region, respectively, for image acquisition. Much less commonly used, they are selected for indications such as pelvic floor imaging.

Harmonic Imaging

T is recent modification of sonography is designed to improve tissue visualization and quality by using several frequencies at once from the transmitted ultrasound beam instead of just a single frequency. Newer probes and postprocessing features improve image resolution, particularly at surface interfaces. Visual artifacts that arise from superficial structures such as adipose are also reduced. As such, tissue harmonic imaging is routinely used in our ultrasound examinations.

Doppler Technology

T is ultrasound technique can be performed with either transabdominal or transvaginal sonography to determine blood flow through pelvic organs, based on the red blood cell (RBC) velocity within vessels, especially arteries. Color Doppler captures and characterizes the spectral waveform of flow through certain vessels seen during real-time imaging. Ratios are often used to compare these different waveform components. T e simplest is the systolic-diastolic ratio (S/D ratio), which compares the maximal (or peak) systolic flow with end-diastolic flow to evaluate downstream impedance to flow (Fig. 2-3). Of arterial Doppler spectral waveform parameters, the resistance index and pulsatility index are also commonly calculated. T ese quantitative indices estimate the impedance to RBC velocity within the artery by expressing the differences between the peak systolic and end-diastolic velocities.

A second application is *color Doppler mapping*, in which the color-coded pulsed-Doppler velocity information is superimposed on the real-time gray-scale image. T e color is scaled, such that the color brightness is proportional to the flow velocity. Additionally, color Doppler also provides information regarding blood flow direction, and color is assigned to this. Flow approaching the transducer is customarily displayed in red, and flow away from it is shown in blue.

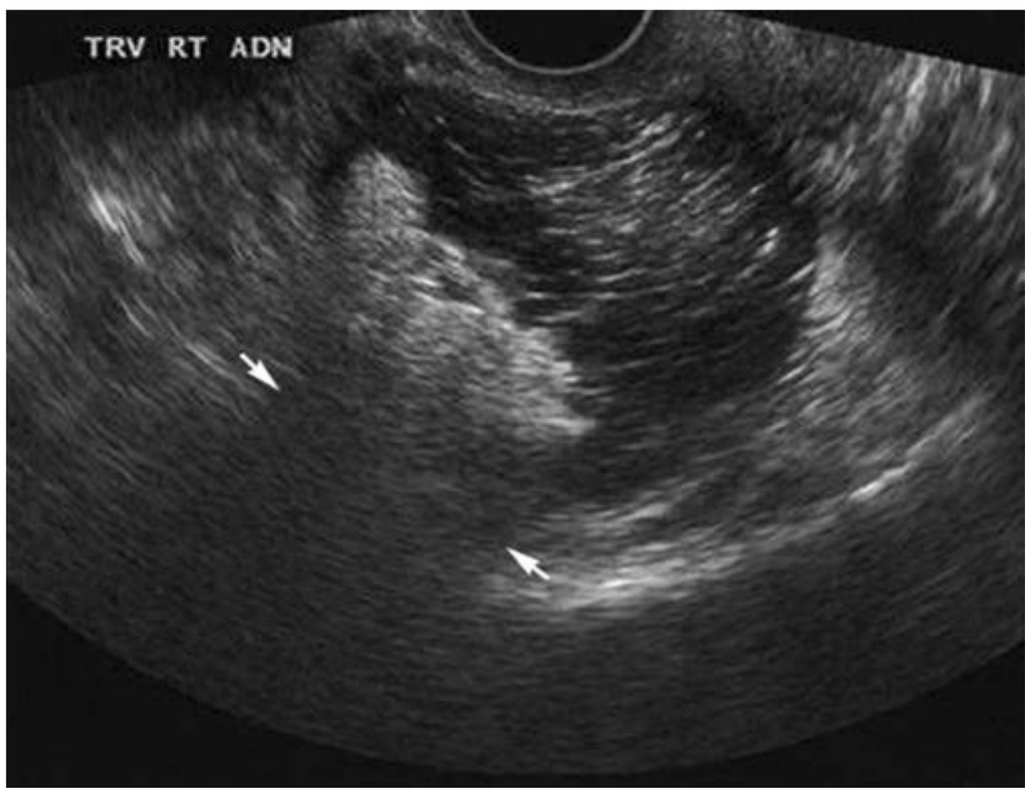
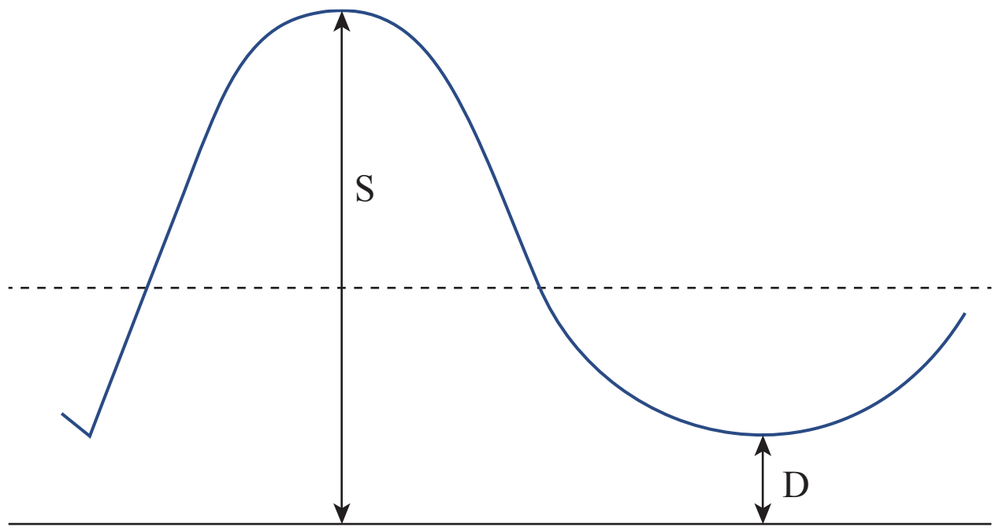


FIGURE 2-2 Transvaginal sonogram of an ovarian teratoma demonstrating posterior acoustic shadowing (arrows).



$$\frac{S}{D} = \text{S/D Ratio}$$

$$\frac{S - D}{S} = \text{Resistance index}$$

$$\frac{S - D}{\text{Mean}} = \text{Pulsatility index}$$

FIGURE 2-3 Doppler systolic–diastolic waveform indices of blood flow velocity. S represents the peak systolic flow or velocity, and D indicates the end-diastolic flow or velocity. The mean, which is the time-average mean velocity, is calculated from computer-digitized waveforms. (Reproduced with permission from Cunningham FG, Leveno KL, Bloom SL, et al: Williams Obstetrics, 24th ed. New York: McGraw-Hill Education; 2014.)

Color Doppler is not applied during every general gynecologic examination. One frequent indication is adnexal mass. Neovascularity within cancer is composed of abnormal vessels that lack smooth muscle and contain multiple arteriovenous shunts. Consequently, lower-impedance flow is expected with such masses as shown in Figure 2-4 (Kurjak, 1992; Weiner, 1992). Other indications include evaluation of ovarian masses for torsion, improved detection of extrauterine vascularity associated with ectopic pregnancy, and assessment of uterine perfusion in patients with leiomyomas and endometrial disorders (Fleischer, 2005). Due to safety concerns regarding the higher intensities generated by color and spectral Doppler, routine use of Doppler imaging in the first trimester is discouraged, unless needed for an important clinical indication.

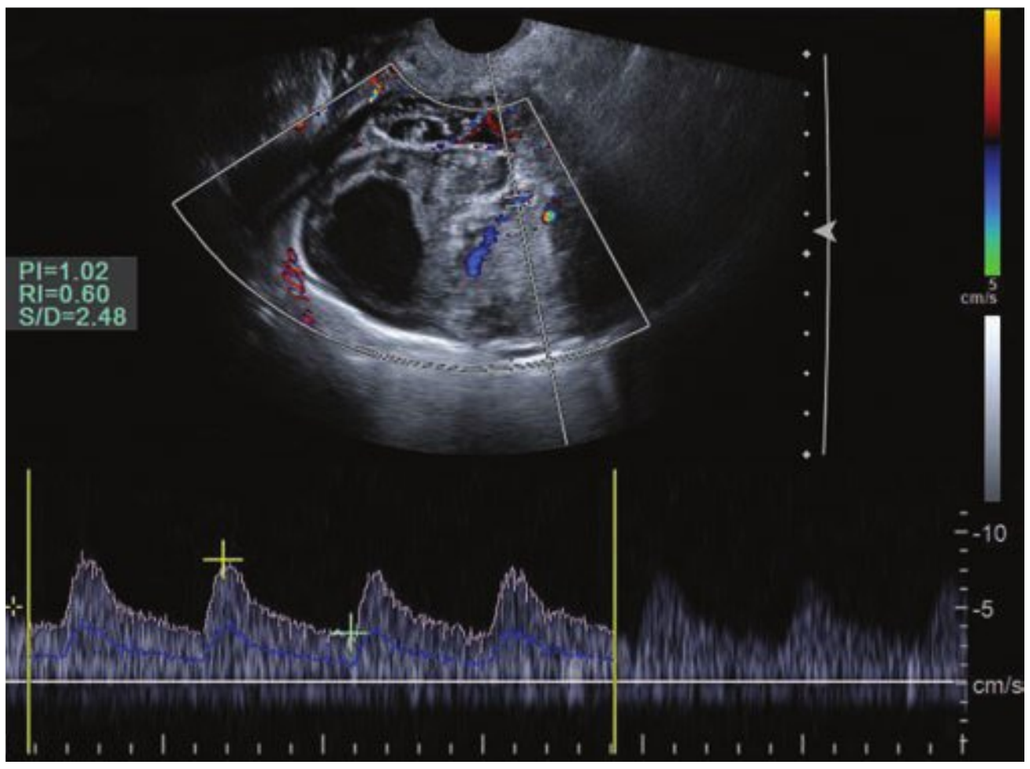


FIGURE 2-4 Complex ovarian mass with irregular cystic areas demonstrating intermediate-impedance [PI = 1.02] flow in a solid component. This mass was found to be a mucinous adenocarcinoma at surgery.

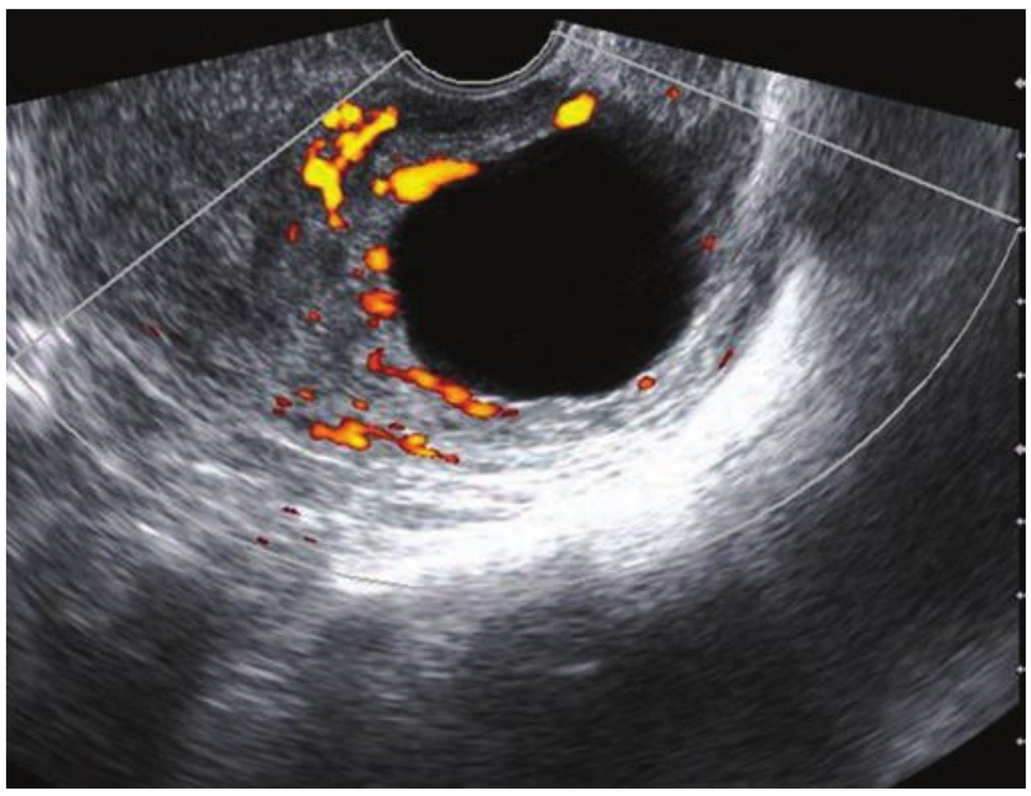


FIGURE 2-5 Power Doppler evaluation of a gestational sac in the lower uterine segment at the cesarean delivery scar. Circular flow is depicted, consistent with the peritrophoblastic flow of an implanted pregnancy.

Power Doppler imaging also maps RBC motion. It detects the energy of Doppler signals generated from moving RBCs using signal-to-noise characteristics of the vessels compared with surrounding tissues. T is modality gives no information regarding blood flow direction, and thus data are displayed as a single color, usually yellow or orange. However, power Doppler is more sensitive to low-flow velocities, such as in veins and small arteries. Although employed less often than color Doppler mapping, power Doppler can gather additional information regarding endometrial and ovarian abnormalities (Fig. 2-5).

Saline Infusion Sonography

Also called sonohysterography, saline infusion sonography (SIS) displays detailed endometrial cavity anatomy by distending the cavity with sterile saline. It is commonly selected after an endometrial mass or abnormal endometrial thickness is identified during general TVS. SIS can also assist in some infertility investigations and aid viewing of the endometrial thickness if it is poorly imaged because of uterine position or pathology.

After voiding, a woman first undergoes a comprehensive TVS evaluation. A vaginal speculum is then inserted, the vagina and cervix are swabbed with an antiseptic solution, and a catheter primed with sterile saline is advanced into the cervical canal and just past the internal os. We do not routinely use a tenaculum for this. Contact with the uterine fundus is ideally avoided when advancing the catheter to avert pain or vasovagal response. It can also shear away endometrium, causing false-positive results. T e speculum is carefully removed to avoid dislodging the catheter, the transvaginal probe is reinserted, and sterile saline is injected through the catheter at a rate based on the patient's tolerance. Usually not more than 20 to 40 mL is required to distend the endometrial cavity (Fig. 2-6). During this time, the cavity is observed with TVS. T e sonographer scans in the longitudinal plane, imaging from one cornu to the other, and in the transverse plane, from the top of the fundus to the cervix. Endometrial surface irregularities are well delineated by the anechoic contrast of saline. At the procedure's

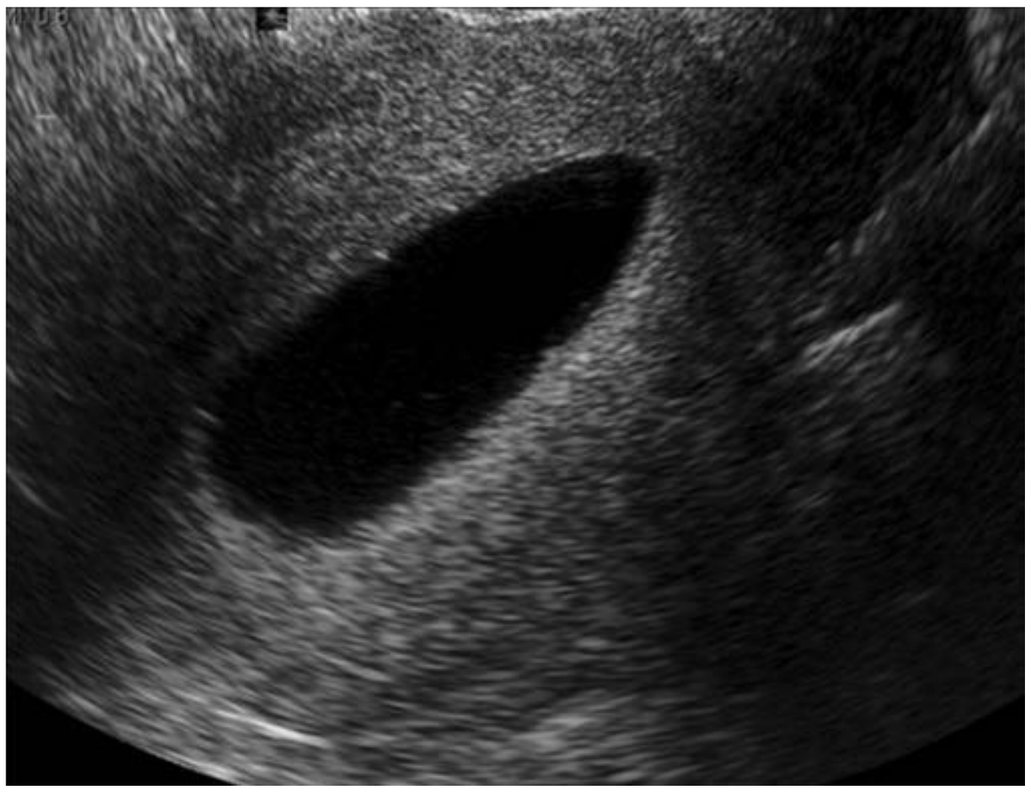


FIGURE 2-6 Saline infusion sonography of a normal endometrial cavity.

conclusion, the catheter is withdrawn under sonographic visualization. The uterine isthmus, endocervical canal, and upper vagina and vaginal fornices may also be evaluated, and this technique is referred to as *sonovaginography*. On average, the entire procedure lasts 5 to 10 minutes.

Many different catheter systems are available, including rigid systems and flexible catheters with and without attached balloons. We use a 7F SIS balloon catheter set, which tamponades the internal cervical os. This blockade prevents backflow of the distending medium and provides stable filling and adequate distention. We have found it easy to place and well tolerated (Fig. 2-7). Several distending solutions have been described, including saline, lactated Ringer solution, and 1.5-percent glycine. Sterile saline is inexpensive and provides optimal imaging. Alternatively, gel and foam substances have been developed to avoid backflow problems. However, these alternative products have not been extensively investigated and are not used widely in clinical practice.

In the premenopausal woman, SIS is best performed within the first 10 days of the menstrual cycle, and optimally on cycle days 4, 5, or 6 when the lining is thinnest. This timing is recommended to avoid misinterpreting menstrual blood clots as intrauterine pathology or missing pathology obscured by thick endometrial growth. In addition, such timing usually precludes disturbing a potential pregnancy. For the postmenopausal woman, timing of the procedure is not cycle-dependent.

Complications of SIS are minimal, and the risk of infection is less than 1 percent (Bonnamy, 2002). The American College of Obstetricians and Gynecologists (2014) recommends prophylactic antibiotics for women with prior pelvic inflammatory disease (PID) or identified hydrosalpinges. In these cases, doxycycline 100 mg orally twice daily is prescribed for 5 days. Although not strongly evidence-based, we also routinely give a single dose of doxycycline, 200 mg orally, for infection prophylaxis following SIS to immunocompromised women, such as those with diabetes, cancer, or human immunodeficiency virus infection. Prophylaxis is also given to infertile patients because of the risk for significant tubal damage associated with pelvic infection. Pain is usually minimal. In our experience, women with prior tubal ligation have greater discomfort, likely because fluid is unable to efflux through the fallopian tubes. A nonsteroidal antiinflammatory drug (NSAID) given 30 minutes prior to the procedure will typically minimize discomfort.

Contraindications to SIS include hematometra, pregnancy, active pelvic infection, or obstruction such as with an atrophic or stenotic cervix or vagina. In postmenopausal women with cervical stenosis, we have found the following techniques to be helpful: misoprostol 200 µg tablet orally the evening before and the morning of the procedure; a paracervical block with 1-percent lidocaine without epinephrine; a tenaculum on the cervix for traction; and a sonographically guided sequential cervical dilation with lacrimal duct dilators. Pisal and colleagues (2005) proposed using a 20-gauge spinal needle, inserted into the uterine cavity under sonographic guidance, to overcome severe cervical stenosis.

Hysterosalpingo-contrast Sonography

In the past, a fallopian tube could be detected with sonography only when distended by fluid, such as with obstruction. Injection

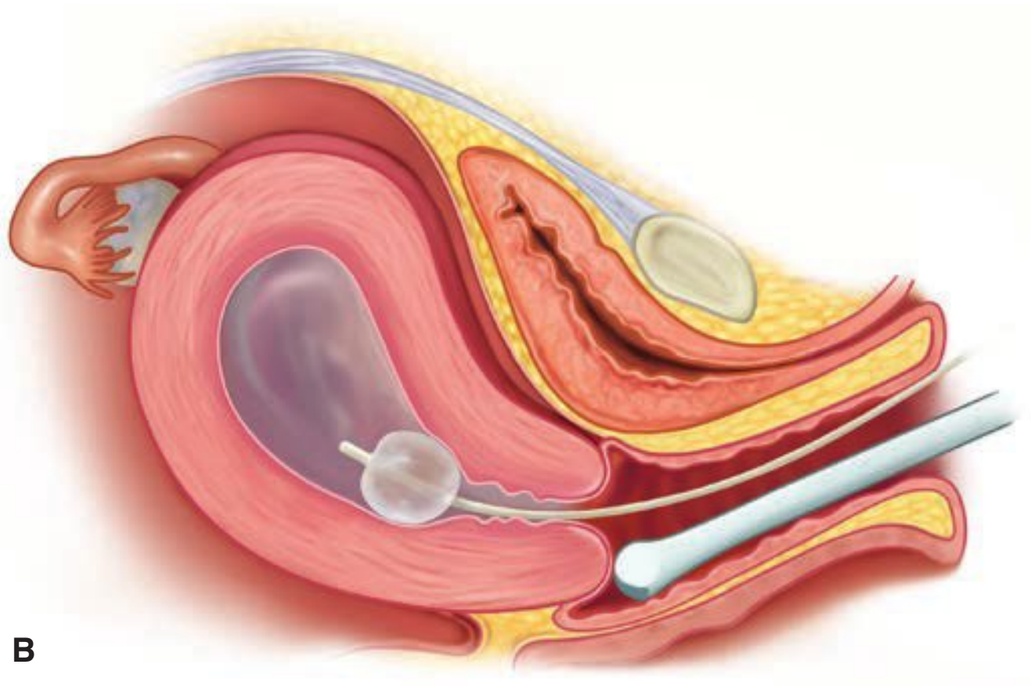


FIGURE 2-7 **A.** Saline infusion sonography catheter. **B.** Saline infusion sonography.

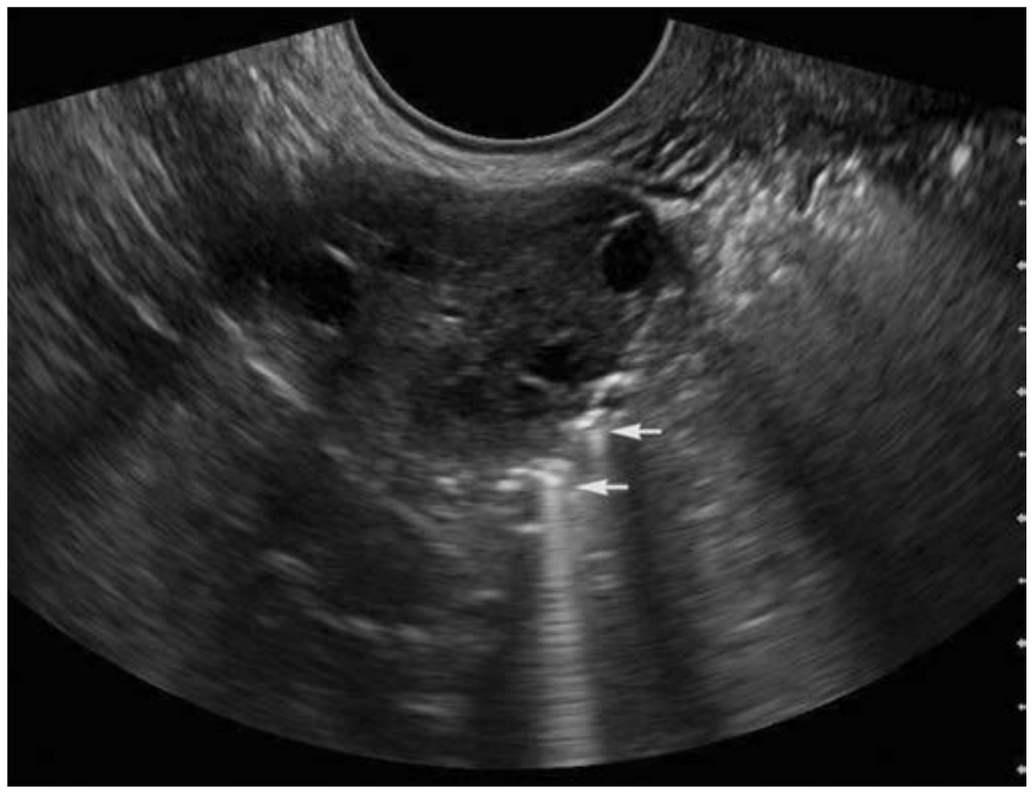


FIGURE 2-8 Transvaginal image of an ovary with echogenic bubbles adjacent to it (arrows) as seen during hysterosalpingo-contrast sonography (HyCoSy). The air in the saline contrast produces the bright echoes and ring-down artifacts. Visualization of these echoes adjacent to the ovary represents contrast exiting the tube, consistent with tubal patency.

of echogenic contrast during real-time sonography, called sonosalpingography, sonohysterosalpingography, or hysterosalpingo-contrast sonography (HyCoSy), is now an accurate procedure for the tubal patency assessment (Hamed, 2009).

HyCoSy is done in a manner similar to SIS. Fluid egress from the uterine cavity is blocked by a balloon catheter within the cervical canal. Using transvaginal sonography, the fallopian tubes are identified at the point where they join the uterine cornua. A hyperechoic sonographic contrast medium (Echovist, Albunex, or Infoson) is injected through the catheter to fill the cavity and then the fallopian tubes (Fig. 2-8). Alternatively, air coupled with sterile saline solution is another contrast option. With either medium choice, patent tubes appear hyperechoic as they fill with contrast. Color or pulsed Doppler techniques increase the diagnostic accuracy of HyCoSy by showing flow velocity within the tubes (Kupesic, 2007). We use the FemVue Sono Tubal Evaluation System, which simultaneously introduces air and sterile saline in a controlled fashion. T e positive pressure flow of the echogenic mixture creates "scintillations" that are visually followed using real-time ultrasound. In patent tubes, flow proceeds from the uterotubal junction, through the length of the tube, and out the fimbriated end. Bubbles then surround the ovary or fill the posterior cul-de-sac. At present no large studies quantitate a risk for post-HyCoSy pelvic infection, and our periprocedural antibiotic prophylaxis mirrors our SIS protocol.

HyCoSy performed in conjunction with SIS provides a comprehensive assessment of the uterine cavity and myometrial anatomy, tubal patency, and adnexal architecture. T is allows a cost-effective and time-ef cient "one-stop" evaluation (Saunders, 2011). However, HyCoSy does have limitations. We have found that the entire fallopian tube often cannot be visualized due to normal tubal tortuosity. To that end, recent studies have evaluated the combination of 3-D sonography with HyCoSy to more easily view the entire tubal length (Exacoustos, 2013; Zhou, 2012). Similar to hysterosalpingography (HSG), discussed on page 38, HyCoSy can demonstrate false occlusion from tubal spasm. In addition, a patent tube does not always correlate with normal tubal function. Last, HSG may still be needed for more accurate delineation of tubal anatomy in selected cases (Mol, 1996).

Although comparable to HSG in detecting tubal pathology, it has only recently become routinely used clinically (Heikinen, 1995; Strandell, 1999). In comparison to HSG, HyCoSy can also be performed in an outpatient setting, has lower cost, is well tolerated, avoids x-ray exposure or iodine-related allergic reaction, and provides information on uterine wall and ovarian morphology (Luciano, 2014; Savelli, 2009). T e advantages of HyCoSy compared with HSG are equally valid for patient evaluation following sterilization with hysteroscopic devices. Namely, with Essure microinsert coils, tubal blockage confirmation 3 months after sterilization is mandatory (Luciano, 2011). Still, the Food and Drug Administration (FDA) and manufacturer currently recommend HSG to demonstrate tubal occlusion by Essure.

Three-dimensional Sonography

Technical Aspects. T e ability to obtain certain views of pelvic organs in two dimensions is inherently limited. Transabdominally, the bony pelvis prevents scanning from the pelvic sidewall. Transvaginally, the views obtainable are restricted by the range of vaginal probe mobility. New sonography scanners now allow collection of 3-D data and representation of it on a two-dimensional (2-D) screen. T is permits a more detailed assessment of the object studied, without restriction of the number and orientation of the scanning planes. With 3-D imaging, any desired plane through a pelvic organ can be obtained, regardless of the sound beam orientation during acquisition. For example, the "face-on" or coronal plane through the uterus is routinely seen in 3-D imaging but is rarely viewed during 2-D scanning. T is view of the uterus is essential for assessing the external contour of the uterine fundus and the shape of the endometrial cavity for congenital uterine anomaly diagnosis.

With 3-D sonography, a volume, rather than a slice, of sonographic data is acquired and stored. T e stored data can be reformatted and analyzed in numerous ways, and navigation through the saved volume can show countless planes. At any time, the volume can be retrieved, studied, reconstructed, and reinterpreted as needed. In addition, the level of energy with 3-D sonography is no higher than with 2-D, and manipulations of the obtained volumes are performed "off-line" to avoid additional ultrasound scanning time.

T e three main components of 3-D sonography are volume acquisition, processing, and display. First, the preferred method to acquire volumes is automated and uses a dedicated 3-D probe that contains a mechanized drive. When these probes are activated, the transducer elements automatically sweep through the operator-selected region of interest, called a *volume box*, while the probe is held stationary.

After the appropriate volume is acquired, the user can begin to process the volume using the modes available in the ultrasound machine. T e acquired volume can be displayed multiple ways. T e most common is multiplanar reconstruction,

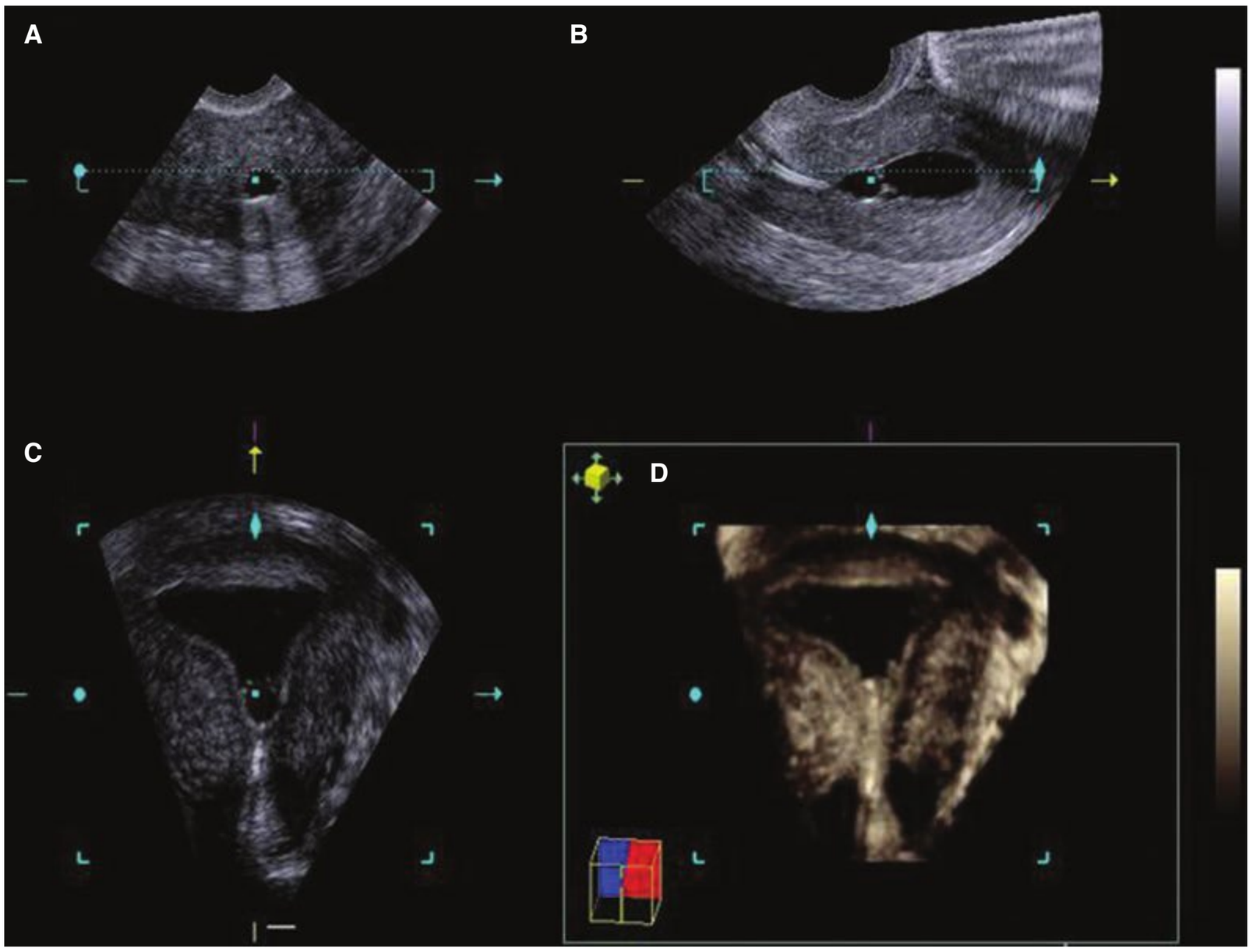


FIGURE 2-9 Multiplanar display of a 3-dimensional volume of a uterus and normal endometrial cavity during saline infusion sonography. The views were obtained from a midsagittal reference plane using the Z technique. The planes are as follows: **A.** transverse, **B.** sagittal, **C.** coronal, **D.** rendered image.

in which three perpendicular planes, sagittal (the longitudinal plane that divides the body into right and left sections), axial (the transverse plane that divides the body into cephalad and caudal sections), and coronal (the frontal plane that divides the body into ventral and dorsal sections), are displayed simultaneously. Correlation between the three planes in the multiplanar display is accomplished by placing the planar center dot at the point of interest in one plane and observing the location of the corresponding center dots in the other two planes (Fig. 2-9A-C).

Abuhamad and associates (2006) have described a straightforward postprocessing technique, called the Z technique, that aids in the manipulation of 3-D volumes of the uterus. T e anatomic basis of the Z technique is such that, in aligning the midsagittal and midtransverse planes of the uterus parallel to the horizontal axis, the midcoronal plane of the uterus will easily and consistently be displayed. In addition, all or part of the saved volume can be processed into a rendered image that can be shown alone or in correlation with the multiplanar display. A rendered image is a "sum" of all the coronal planar images (Fig. 2-9D). T is is the display method that has been publicized in obstetrics, when showing the image of the neonate's face in utero.

T e inverse mode is a rendering technique of the entire volume in which all cystic areas within the volume become digitally opaque and all solid areas become transparent. T is technique is useful when trying to see cystic areas that might be hidden in a volume, such as within an ovarian mass. Last, the volume can be displayed in parallel tomographic slices, similar to the displays used by CT and MR imaging.

3-D imaging is not without shortcomings. With 3-D sonography, the same type of acoustic artifacts that occur with 2-D imaging are encountered, such as acoustic shadowing and enhancement, refraction and reverberation, and motion artifacts from bowel peristalsis and vascular pulsation. Another potential pitfall in 3-D imaging of the pelvis involves spatial orientation within the saved volume data. Uterine flexion or version or left versus right may not be readily apparent on review of saved volumes. As such, during the preliminary real-time scanning, the operator must determine the orientation of the area of interest and notate it accordingly.

Another problem commonly encountered in 3-D transvaginal gynecologic imaging is related to the limited size of the volume box. Because of this, the entire uterus is often not acquired in a single volume. In some cases, it may be necessary to acquire two volumes, one for the cervix and a second for the uterine body. Likewise, a very large adnexal mass may not be imaged completely in any single volume of data obtained transvaginally. T e size of the volume box provided by the abdominal probe is greater. T us with 3-D sonography, a large mass may need to be imaged transabdominally instead of transvaginally.

Clinical Use. Because it can study organs in numerous scanning planes, 3-D imaging has become invaluable in gynecology to assess the uterine cavity, complex ovarian masses, ovarian fertility reserve, uterine anomalies, and interstitial pregnancies. It also can simultaneously provide anatomic and dynamic information from pelvic floor structures and from mesh implants.

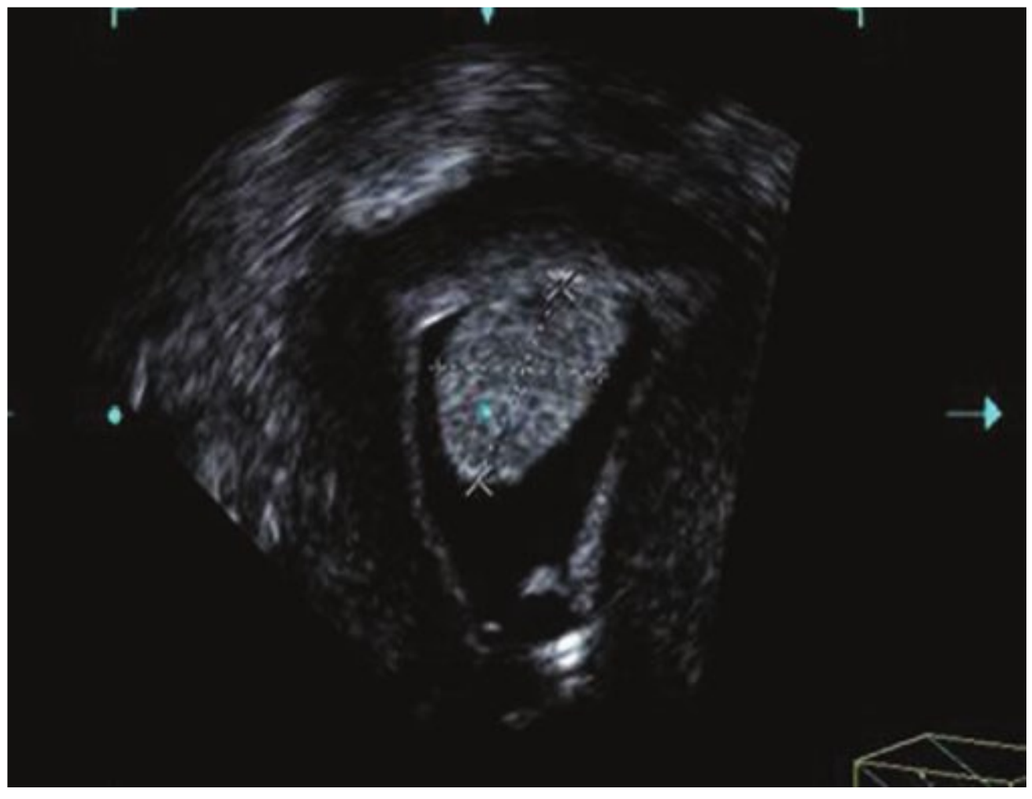


FIGURE 2-10 Three-dimensional image in the coronal plane of a polyp (calipers) after instillation of saline during saline infusion sonography.

Of these, mapping leiomyoma location relative to the endometrial cavity and surrounding structures is an essential step in triaging patients for treatment as discussed in Chapter 9 (p. 206). For such mapping, 3-D sonography or 3-D SIS can be used in place of conventional SIS or MR imaging. In patients receiving gonadotropin-releasing hormone (GnRH) agonists or following uterine artery embolization (UAE), 3-D sonography can also monitor leiomyoma volume reductions. However, MR imaging is more often used following UAE.

Abnormalities of the endometrium and adjacent myometrium, especially focal endometrial thickenings such as polyps, hyperplasia, and cancer, can be better defined with 3-D technology (Fig. 2-10) (Andreotti, 2006; Benacerraf, 2008). In their comparative study of 36 women with postmenopausal bleeding, Bonilla-Musoles and associates (1997) compared results from 3-D SIS with findings from TVS, 2-D SIS, transvaginal color Doppler, and hysteroscopy. Visualization of the uterine cavity and endometrial thickness with 3-D SIS was comparable to hysteroscopy and better than the other sonographic techniques. We now routinely implement 3-D imaging for evaluation of abnormal endometria during our transvaginal studies and with all SIS procedures.

Although investigational, 3-D sonography with power Doppler angiography (3D-PDA) has been used to discriminate between benign and malignant endometrial disease in women with postmenopausal bleeding and a thickened endometrium (Alcazar, 2009). 3D-PDA can assess endometrial volume, which may more accurately represent the true tissue amount compared with a 2-D measurement of endometrial thickness. Another tool, 3-D power Doppler imaging enhanced by intravenous (IV) contrast, is also being investigated to differentiate benign endometrial polyps and endometrial cancer (Lieng, 2008; Song, 2009).

IUD positioning within the endometrial cavity can be documented adequately in most cases with traditional 2-D TVS. That said, 3-D sonography offers improved visualization, especially with the levonorgestrel-releasing IUD (Moschos, 2011). The coronal plane images, which are not possible with 2-D imaging, provide views of both the arms and shaft of the device and the relation of these to the endometrial cavity (Benacerraf, 2009). As such, patients at our institution undergoing gynecologic sonography with an IUD in situ, regardless of the study indication, have both a standard 2-D evaluation and a 3-D volume acquisition of the uterus. The coronal view of the endometrial cavity is reconstructed to establish IUD type, location, and positioning (Fig. 2-11). In addition, although the FDA still mandates a postprocedural HSG following Essure coil placement, TVS has been shown to be an acceptable method of confirmation (Fig. 2-12) (Legendre, 2010).

For adnexal mass interrogation, most agree that 3-D sonography provides detailed internal anatomy (Alcazar, 2003; Bonilla-Musoles, 1995). Moreover, the addition of power Doppler to 3-D evaluation displays the internal architecture and neovascularization also characteristic of malignant neoplasms. However, to date, 3-D power Doppler ultrasound has not shown significantly improved diagnostic accuracy compared with that

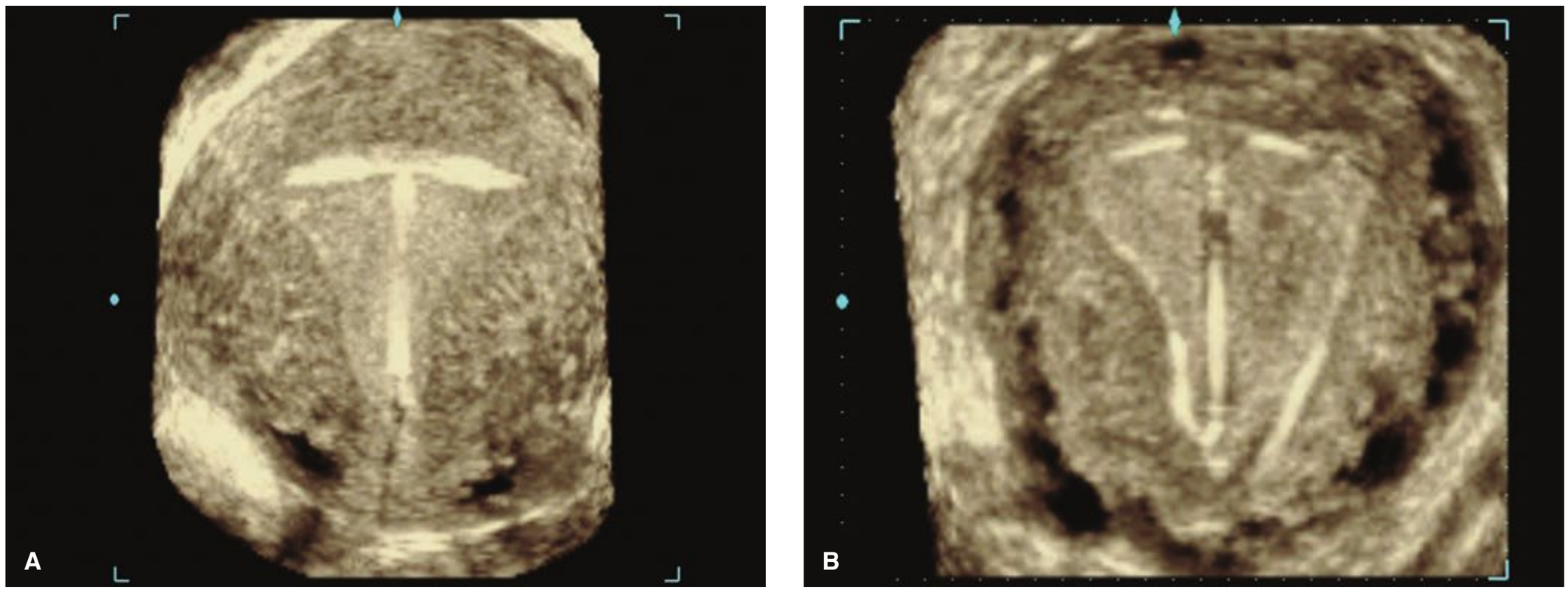


FIGURE 2-11 Intrauterine devices (IUDs). The coronal planes of 3-dimensional sonography best depict the type and positioning of the Copper T 380A IUD (ParaGard) **(A)** and levonorgestrel-releasing IUD (Mirena) **(B)** IUDs within the endometrial cavity.