



Harvard Women's Health Watch

VOLUME 17 • NUMBER 9 | MAY 2010

Advances in breast imaging

Although mammography remains standard for breast cancer screening, several newer technologies are helping to fine-tune diagnosis.

Doctors have been making radiologic images of women's breasts for almost a century. The first, taken in 1913, were x-rays of breasts that had been surgically removed. In studying these early images, doctors found that they could distinguish malignant from benign tissue, even when cancer hadn't been suspected. Here was a possible alternative to the then-standard detection method—removing a palpable lump (if not the entire breast) and examining the tissue under a microscope.

At first, breast x-rays were disappointing. The images were often blurred by the beating of the heart, and it was difficult to distinguish tumors from breast ducts. But decades of research eventually produced x-ray equipment specifically designed for breast imaging. The new machines used low-energy x-rays and produced crisper images. New devices com-

pressed the breast between two plates, reducing breast movement and smoothing out the tissue. By the late 1960s, mammography as we know it had been born.

Since then, new imaging methods have been developed, and today, a variety of technologies—including ultrasound, magnetic resonance imaging (MRI), and molecular imaging—are used to examine the breast.

Mammography

Mammography remains the “gold standard” screening method for women at average risk for breast cancer. It is relatively inexpensive, requires only a low dose of radiation, and reliably identifies malignant tumors, especially those that are too small to feel. It can also be used to investigate breast lumps and other symptoms.

How it works: X-ray radiation passes through the breast, producing an image on film or on a digital recording plate.

What it involves: Whether the mammography is film or digital, your experience will be the same. You'll remove your clothes above the waist and don an open-front hospital gown. A technologist will adjust the imaging platform to your height, arrange your breast on it, and position your arms and torso. A specially designed clear paddle will be lowered to compress your breast. For a routine screening mammogram, two images of each breast are taken—one from above and one obliquely from the side. Diagnostic mammograms may require more images. The procedure takes anywhere from 15 minutes to an hour.

Ultrasound

Ultrasound imaging—also called sonography—may be used to evaluate abnormalities

IN THIS ISSUE

What to do about aching kneecaps 4

Patellofemoral pain usually improves with conservative measures, including exercise to strengthen the quadriceps muscles.

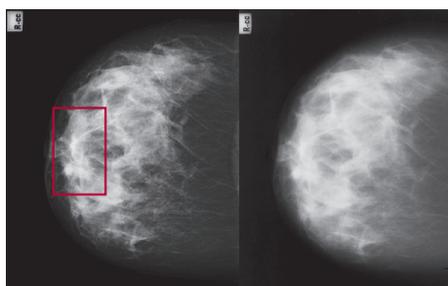
In the journals 6

Some diabetes drugs are linked to fractures, but alternatives are available.

By the way, doctor 7–8

What are the health risks for DES daughters and their children? What do you know about the HCG diet? What can I do about twitching eyelids?

How digital mammograms help



On regular mammograms, fat looks dark gray, and breast tissue, which is denser, is white. Abnormalities, such as lumps, also appear white, making it difficult to distinguish them from the surrounding tissue. In the digital mammogram (left), a cancerous mass can be seen as solid white (boxed in red), just behind the nipple. The tumor is harder to spot on a standard mammogram (right) of the same breast.

What's new

Women's Health After 50

Special Health Report from Harvard Medical School

To order, call 877-649-9457 (toll-free) or visit us online at www.health.harvard.edu.

Contact us

Write to us at womens_health@hms.harvard.edu

For customer service, write us at harvardWL@strategicfulfillment.com

EDITORIAL BOARD

Board members are associated with Harvard Medical School and affiliated institutions. They review all published articles.

Editor in Chief	Celeste Robb-Nicholson, M.D.
Cardiology	Paula Johnson, M.D., M.P.H.
Dermatology	Suzanne Olbricht, M.D.
Endocrinology	Anne Klibanski, M.D. JoAnn Manson, M.D., Dr.P.H. Karen K. Miller, M.D.
Epidemiology	I-Min Lee, M.D., Sc.D.
Gastroenterology	Stephen E. Goldfinger, M.D.
Genetics	Susan P. Pauker, M.D.
Gynecology	Martha K. Richardson, M.D. Isaac Schiff, M.D.
Internal Medicine	Karen Carlson, M.D. Nancy Rigotti, M.D. Beverly Woo, M.D.
Neurology	Anne B. Young, M.D., Ph.D.
Nutrition	Bruce Bistrian, M.D., Ph.D. Helen K. Delichatsios, M.D., S.M.
Oncology	Judy E. Garber, M.D., M.P.H.
Psychiatry	Ellen Blumenthal, M.D. Malkah T. Notman, M.D. Margaret S. Ross, M.D.
Radiology	Barbara Weissman, M.D.
Surgery	Barbara Smith, M.D., Ph.D.

EDITORIAL STAFF

Editor	Carolyn R. Schatz
Managing Editor	Nancy A. Ferrari
Copy Editor	James C. Sellman
Contributing Writers	Susan Ince, Beverly Merz
Contributing Editors	Christine Junge, Kristie Reilly
Art Director	Heather Derocher
Production Editor	Nicole Wall
Illustrator	Alex Gonzalez

CUSTOMER SERVICE

Phone: 877-649-9457 (toll-free)
E-mail: HarvardWL@StrategicFulfillment.com
Online: www.health.harvard.edu/customer_service
Mail: Harvard Women's Health Watch
 P.O. Box 9308
 Big Sandy, TX 75755-9308
 Subscriptions \$32 per year (U.S.)

Bulk subscriptions

StayWell Consumer Health Publishing
 One Atlantic St., Suite 604
 Stamford, CT 06901
 888-456-1222, ext. 31106 (toll-free)
 203-653-6266
 ddewitt@staywell.com

Corporate sales and licensing

StayWell Consumer Health Publishing
 One Atlantic St., Suite 604
 Stamford, CT 06901
 jmitchell@staywell.com

Editorial correspondence

E-mail: carolyn_schatz@hms.harvard.edu
Letters: Harvard Women's Health Watch
 10 Shattuck St., 2nd Floor
 Boston, MA 02115

Permissions

Copyright Clearance Center, Inc.
Online: www.copyright.com

Published by Harvard Health Publications, a division of Harvard Medical School
Editor in Chief Anthony L. Komaroff, M.D.
Publishing Director Edward Coburn

©2010 Harvard University (ISSN 1070-910X)
 Proceeds support the research efforts of Harvard Medical School.

Harvard Health Publications
 10 Shattuck St., 2nd Floor, Boston, MA 02115

The goal of the Harvard Women's Health Watch is to interpret medical information for the general reader in a timely and accurate fashion. Its contents are not intended to provide personal medical advice, which should be obtained directly from a physician. We regret that we cannot respond to inquiries regarding personal health matters.

PUBLICATIONS MAIL AGREEMENT NO. 40906010
 RETURN UNDELIVERABLE CANADIAN ADDRESSES TO: CIRCULATION DEPT., 1415 JANETTE AVENUE WINDSOR, ON N8X 1Z • E-mail: ddewitt@staywell.com

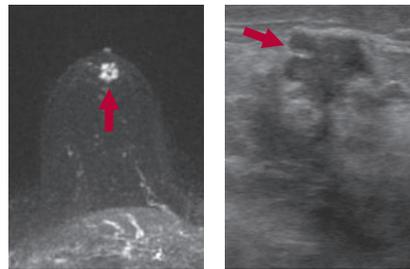
Advances in breast imaging continued

detected during a breast exam or mammogram. Though it can't detect microcalcifications (tiny flecks of calcium that may signal early cancers), it excels in distinguishing solids from liquids, so it's useful for differentiating solid tumors from fluid-filled cysts, which are benign. Ultrasound can also be used to guide needle biopsies.

How it works: Ultrasound creates an image from reflected high-frequency sound waves emitted by a device called a transducer. The technician will run the transducer across the surface of the breast to produce a real-time image of its interior structures. Doppler ultrasound, which tracks the speed of blood coursing through the vessels, is also occasionally added to assess blood flow to breast lesions.

What it involves: With your clothing removed from the waist up and wearing an open-front hospital gown, you'll lie on your back on a padded table under dim light (so that the technician can get a good view of the monitor). A gel will be applied to your

MRI and ultrasound



An MRI image (left) shows a cancerous mass in the right breast. At right is the same mass magnified on an ultrasound image.

Photographs courtesy of Radiological Society of North America.

breast and the transducer will be placed over it. The ultrasound waves are too high a frequency to be heard, and the procedure itself is painless—all you may feel is the slight pressure of the transducer sliding over your breast. The test takes three to 15 minutes.

Magnetic resonance imaging (MRI)

MRI using a special receiver and injected contrast material to image only the breasts is very good at detecting invasive breast cancer. However, it can also misidentify benign lesions as malignant, because both can absorb the contrast. MRI is not a substitute for regular mammography, but the American Cancer Society recommends it for screening women at very high risk for breast cancer. That includes women with known genetic mutations that increase the risk of breast cancer or a very strong family history of breast cancer and women who have had chest irradiation for diseases such as Hodgkin's lymphoma. Once a malignancy is detected, MRI may also be used to find or rule out additional tumors and thus may be helpful in deciding whether breast-conserving surgery or mastectomy is the best treatment option. Also, MRI without the use of contrast material may be employed to determine whether silicone breast implants have ruptured.

How it works: MRI uses a powerful magnetic field and radio frequency pulses that are processed by a computer to create images of organs and tissues. It does not use ionizing radiation (x-rays). The resulting digital images are examined on a com-

Film-screen or digital mammography?

In 2000, the FDA approved the use of digital mammography, which has many of the same advantages as digital photography. Digital images can be enlarged, and the contrast can be adjusted, allowing radiologists to concentrate on suspicious areas and especially to improve the detection of tumors in dense breast tissue (see "How digital mammograms help," page 1). The images can also be stored and transmitted electronically, for ready comparison from year to year and for consultations with experts at a distance.

According to the Digital Mammography Imaging Screening Trial (involving almost 50,000 women), the difference between film and digital mammography is negligible for most women over age 50, but digital images have an edge over film for three other, often overlapping groups—women under age 50, women who are pre- or perimenopausal, and women who have dense breasts. If any of those descriptions fit you, you should talk to your clinician about the possibility of having a digital mammogram at your next screening.

puter monitor, and like digital mammograms, MRI images can be stored and transmitted electronically.

What it involves: You will change into a hospital gown and remove any metal-containing jewelry or devices (like hearing aids) that might interfere with the magnet. An intravenous (IV) catheter will be inserted into your arm or hand, and you will receive an injection of a compound containing gadolinium to outline the structures of the breast on the MRI image. Then you will lie on your stomach on a padded table, and your breasts will be positioned into padded openings within a special coil, or receiver, that detects the magnetic signal. The table is then moved into the machine that contains the magnet. You will be given earplugs or possibly headphones for listening to music during the procedure to muffle the knocking sound emitted each time an image is taken. The MRI session takes 30 to 45 minutes.

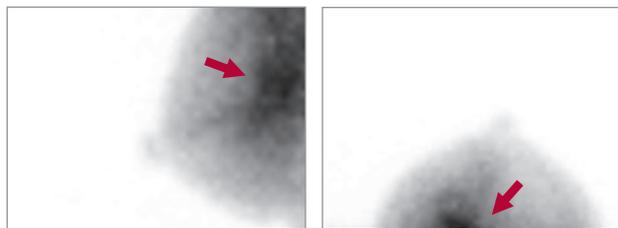
Positron emission mammography (PEM)

PEM is used in addition to mammography to identify small invasive cancers and ductal carcinoma in situ (DCIS)—cancer that is confined to the milk ducts. PEM is not yet widely available and may not be covered by insurance.

How it works: A radioactive glucose tracer emits gamma rays that are detected by a camera. Because glucose is absorbed and stored more readily in rapidly growing cells—like cancer cells—a tumor accumulates higher concentrations of the tracer than healthy tissues and shows up as a “hot spot” on the photographic image. A computer analyzes the image to determine the size, shape, and location of the mass.

What it involves: You'll need to avoid eating or drinking anything except water in the six hours before the test. The technologist will check your blood glucose level with a finger-prick test, and if the results are normal, a radioactive glucose tracer will be injected into your arm. You'll wait for an hour as your body absorbs the tracer. From then on, PEM is much like a mammogram, except that you'll be seated in a chair at the scanner. Two scans are made of each breast, and the entire procedure takes about two hours.

Positron emission mammography (PEM)



These are positron emission mammography (PEM) images of the right breast of a 39-year-old woman with invasive ductal breast cancer. The cancer absorbs more radioactive tracer and shows up as a dark area. The image on the left is taken from the side of the breast at an angle and the one on the right is taken from above.

Photographs courtesy of Radiological Society of North America.

Thermography: Not a screening option

Thermography, a technique originally designed for night-vision devices used by the U.S. military, records the temperature of the body by measuring the infrared radiation it emits. Malignant tissue generally has a higher temperature than normal tissues because of its richer blood supply and higher metabolic rate, so scientists reasoned that infrared “hot spots” in the breast might signal the presence of cancer. Thermography is approved as an adjunctive tool for diagnosing breast cancer, but it produces too many false-positive results to be useful as a screening tool.

Breast-specific gamma imaging (BSGI)

Like PEM, BSGI is used as an adjunct to mammography, is not widely available, and may not be covered by insurance.

How it works: BSGI also employs a radioactive tracer to identify cancer cells. In this case, the substance used is technetium sestamibi, a compound that accumulates in mitochondria, the power plants of the cells. Rapidly proliferating cells are rich in mitochondria, and the tracer will concentrate there, emitting gamma rays that produce dark spots on a digital image.

What it involves: Before the exam, an IV catheter will be inserted into your arm or hand. The tracer will be injected into the IV solution and you'll sit quietly for 10 minutes while it's being absorbed. The imaging process is similar to PEM. Two scans are made of each breast, and additional scans are sometimes taken of your underarm lymph nodes. The whole procedure takes about an hour.

The future of breast imaging

According to the American Cancer Society, early detection and treatment of breast cancer has saved about 130,000 women's lives in the past 20 years. Much of the credit for that goes to screening mammography. But today, new imaging technologies are playing an increasing role in follow-up studies and the early detection of cancer recurrences. In the coming years, surgeons and oncologists may utilize additional new imaging technologies such as PEM and BSGI as part of a less invasive and more effective approach to treating women with breast cancer. ♥

Get more from your subscription

For *Harvard Women's Health Watch* subscribers only

Your FREE online health library

Paid subscribers can access all articles and issues of *Harvard Women's Health Watch* from the last three years. Simply activate your account on our Web site to access a virtual health information library—authoritative health information from Harvard Medical School on the topics you want, when you want it.

To activate your online account, visit our Web site at www.health.harvard.edu/library and follow the simple instructions for Online Account Activation.

Source: from Harvard Women's Health Watch, Harvard Health Publications, Copyright 2010 by President and Fellows of Harvard College. All rights reserved.

Harvard authorizes you to view or download a single copy of the Harvard Content on EBSCOhost solely for your personal, noncommercial use if you include the following copyright notice: "Copyright, President and Fellows of Harvard College. All rights reserved" and other copyright and proprietary rights notices which were contained in the Harvard Content. Reproduction and/or redistribution of the Harvard Content is expressly prohibited. Any special rules for the use of other items provided on EBSCOhost may be included elsewhere within the site and are incorporated into these Terms and Conditions.

The Harvard Content is protected by copyright under both United States and foreign laws. Title to the Harvard Content remains with President and Fellows, Harvard College. Any use of the Harvard Content not expressly permitted by these Terms and Conditions is a breach of these Terms and Conditions and may violate copyright, trademark, and other laws. Harvard Content and features are subject to change or termination without notice in the editorial discretion of Harvard. All rights not expressly granted herein are reserved to President and Fellows, Harvard College.

If you violate any of these Terms and Conditions, your permission to use the Harvard Content automatically terminates and you must immediately destroy any copies you have made of any portion of the Harvard Content.

MEDICAL DISCLAIMER

The information contained in this online site is intended to provide accurate and helpful health information for the general public. It is made available with the understanding that the author and publisher are not engaged in rendering medical, health, psychological, or any other kind of personal professional services on this site. The information should not be considered complete and does not cover all diseases, ailments, physical conditions or their treatment. It should not be used in place of a call or visit to a medical, health or other competent professional, who should be consulted before adopting any of the suggestions in this site or drawing inferences from it.

The information about drugs contained on this site is general in nature. It does not cover all possible uses, actions, precautions, side effects, or interactions of the medicines mentioned, nor is the information intended as medical advice for individual problems or for making an evaluation as to the risks and benefits of taking a particular drug.

The operator(s) of this site and the publisher specifically disclaim all responsibility for any liability, loss or risk, personal or otherwise, which is incurred as a consequence, directly or indirectly, of the use and application of any of the material on this site.