



# On Pins and Needles

Ask any woman who's had one. Breast biopsies are painful and stressful. Even with minimally invasive techniques, a physician has to guide a needle through the breast to a lump in order to obtain a sample of the tissue for examination. Then, there's the tortuous wait for results. But a spate of advanced imaging modalities is helping to identify malignant tumors at earlier stages and avoid unnecessary breast biopsies.

By Diana Smith

In the United States, 1.4 million women undergo breast biopsies each year, according to the American Cancer Society. Worldwide, millions more endure the procedure and the subsequent agonizing wait to find out if a suspicious area is indeed cancer. And after all that, it is estimated that up to 80 percent of the lumps turn out to be benign.

Just ask Barbara Wray, a marketing account manager in Austin, Texas, USA. When Wray had a suspicious spot on her mammogram, she feared the worst: "I called my sister sobbing and just knew I had cancer." Wray's doctor ordered a vacuum-assisted biopsy, a procedure that uses a vacuum technique to assist in the collection of tissue via a hollow core needle. While the minimally invasive procedure was less draining than surgery, it still took a serious emotional and physical toll. "The sucking sound from the vacuum was unnerving, and recovery from the procedure definitely is painful," says Wray. Luckily, after all the emotional and physical toll, Barbara Wray's biopsy turned out to be negative.

### Biopsy: How Much Is Enough?

A breast biopsy removes tissue or fluid for examination by a pathologist to deter-

mine if an abnormality is benign or malignant. Not so long ago, almost all breast biopsies were performed by "open" surgery, a procedure that is done in the operating room and requires sedation and stitches. Surgical biopsies remove a significant amount of tissue (from the size of a grape to a golf ball), cause excessive external scars, and even breast deformities. Plus, the surgeries are costly. Today, minimally invasive biopsies, including core needle and vacuum-assisted procedures, are performed under local anesthesia, are faster, and require less recovery time. They also leave smaller scars and are less expensive than surgical biopsies. Even so, most patients would prefer to opt out of the procedure if possible.

### Imaging Innovations

Imaging techniques play an important role in helping doctors perform breast biopsies, and image guidance depends on how the abnormality is found, whether seen on a mammogram, with ultrasound, or with magnetic resonance imaging (MRI).

In the last decade, breast imaging has undergone a technological revolution. Reinvented familiar technologies as well



**"For dedicated clarification, you need all three: high-quality mammography systems, ultrasound, and MRI."**

Evelyn Wenkel, MD,  
Department of Radiology,  
University Hospital Erlangen, Germany



Figure 1: Suspicious lesion in the left breast with partially unsharp margins in a T1 weighted image.



Figure 2: ADC value of  $1.39 \times 10^{-3} \text{ mm}^2/\text{s}$  indicating a benign lesion.



“Better image quality helps determine a diagnosis and may help avoid biopsies.”

Ilse Vejborg, MD,  
Chief Physician of Mammography,  
Rigshospitalet, Copenhagen, Denmark

as new, sophisticated imaging technologies are making it possible to identify cancer in earlier stages and reduce the number of unnecessary biopsies.

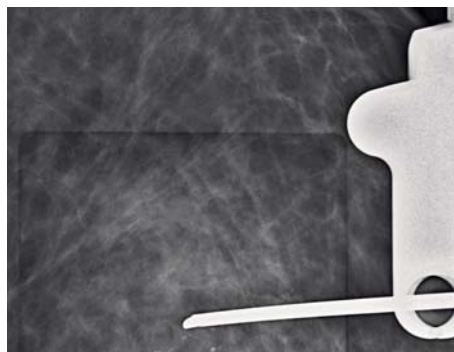
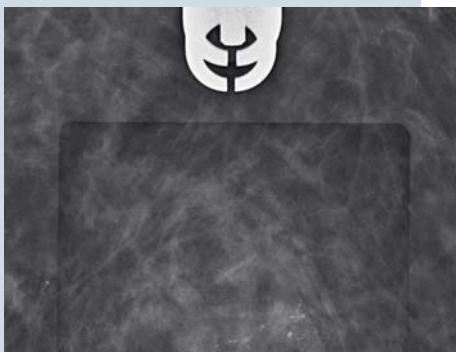
“For dedicated clarification, you need all three: high-quality mammography systems, ultrasound, and MRI,” explains Evelyn Wenkel, MD, Department of Radiology, University Hospital Erlangen, Germany. “Today, the equipment is faster and the resolution is better, so you can detect smaller cancer lesions.” Leading the way is Siemens’ wide range of breast solutions, from digital mammography and ultrasound to contrast-enhanced MRI, and emerging imaging tools, such as 3D tomosynthesis<sup>1</sup>, which provide stellar image quality and other innovations to provide accurate and highly detailed clinical information.

**Mammography: Still the Gold Standard**

“Mammography is still the most important modality to use for early detection,” says Ilse Vejborg, MD, Chief Physician of Mammography at Rigshospitalet in Copenhagen, Denmark. “We know that it will reduce breast cancer mortality.” However, even though mammography is still the gold standard of breast cancer detection, it does present a few shortcomings. Normal breast tissue can hide a breast cancer so that it does not always

show up on a mammogram. This is called a false negative. Mammography can also identify an abnormality that looks like a cancer, but turns out to be normal. This is called a false positive. These “false alarms” mean more tests and repeated trips to the doctor, which can be extremely upsetting and stressful. In recent years, significant improvements have been made regarding mammography technology and interpretation. Worldwide, more centers are relying on full-field digital mammography rather than film-based mammography. Unlike conventional mammography, digital images can be stored and retrieved electronically, which makes long-distance consultations easier. The images can be adjusted by a radiologist so that subtle differences between tissues may be noted, and improved accuracy may reduce the number of follow-up procedures. Mammography is particularly helpful in identifying microcalcifications – tiny deposits of calcium that cannot be felt but can be seen on a mammogram. A cluster of microcalcifications may indicate that cancer is present.

Studies suggest that breast tomosynthesis, which gives a 3D view of the inner structures of the breast, may significantly reduce the numbers of falsely diagnosed tumors. “It is very important to have optimum image quality in mammogra-



Stereotactic biopsy with MAMMOMAT Inspiration<sup>2</sup>: Scout view followed by postfired stereo views. (Courtesy of Rigshospitalet, Copenhagen, Denmark)

<sup>1</sup> Caution: Investigational technology. Limited by U.S. Federal Law to investigational use.  
<sup>2</sup> Device not yet available in the U.S., PMA under review

phy,” emphasizes Vejborg. “Better image quality helps determine a diagnosis and may help avoid biopsies.”

### Ultrasound: New Levels of Detail

Ultrasound is evolving to take on an increasing role in breast cancer detection, although it is not used for routine breast cancer screening because it does

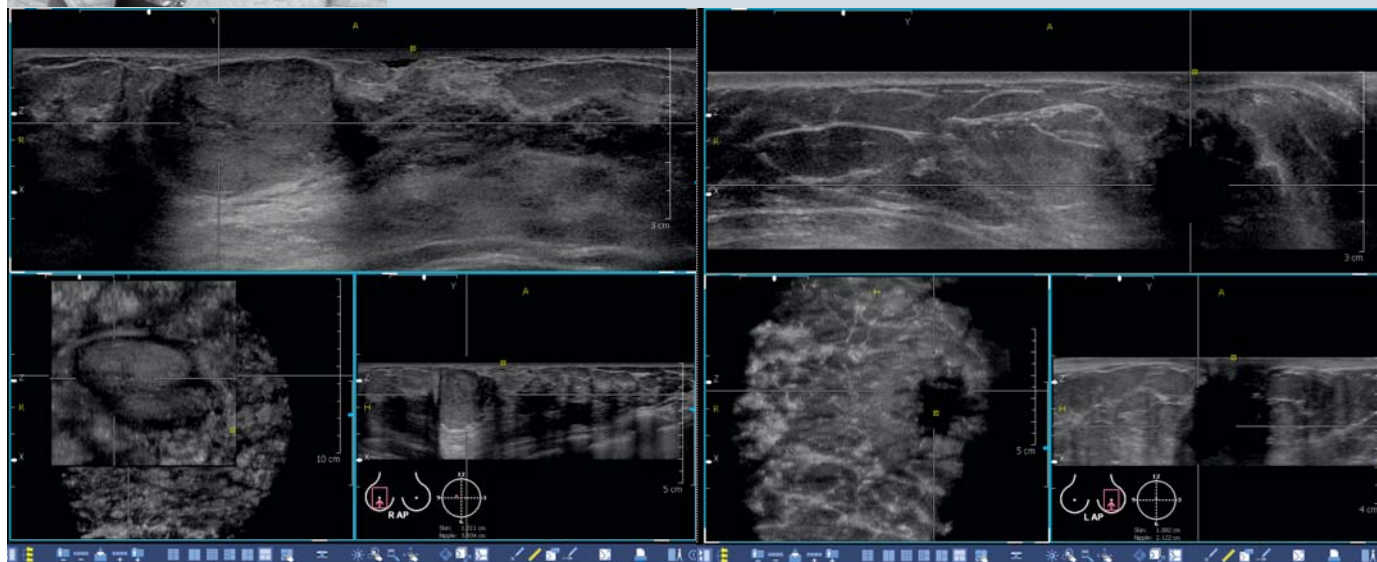
not consistently detect early signs of cancer such as microcalcifications. This imaging technique uses high-frequency sound waves that are bounced off tissues and internal organs, producing a picture or sonogram from the echoes. Breast ultrasound is used to distinguish between solid tumors and fluid-filled cysts. “Ultrasound is complementary to mammography,” says Dr. Vejborg. “Many times, we

find tumors that we can’t see on mammography, but can see on ultrasound.” Ellen Mendelson, MD, Chief of Breast and Women’s Imaging at the Lynn Sage Comprehensive Cancer Center, Northwestern Memorial Hospital, in Chicago, Illinois, USA, agrees. “When a screening or diagnostic mammogram doesn’t show any abnormalities in the breast, ultrasound can greatly improve the ability to



“The wonderful detail now available is really helpful in confidently saying this is more than likely to be malignant, or on the other hand, saying the likelihood is greater for a benign mass.”

Ellen Mendelson, MD, Chief of Breast and Women’s Imaging,  
Lynn Sage Comprehensive Cancer Center, Northwestern Memorial Hospital,  
Chicago, Illinois, USA



A 17-year-old patient with large palpable mass, a fibroadenoma, and many other smaller, similar well-depicted masses. Top view is the wide B-mode acquisition, the coronal reconstruction with magnification glass over the mass in the lower left corner. In the right lower corner is a reconstruction orthogonal to the plane of the B-mode acquisition. The diagrams beneath show the location of the lesion as indicated by the cross hairs, which correlate the views. The patient requested a core biopsy, and it was done immediately after completion of the automated breast volume scanning study with guidance from the ACUSON S2000 system (handheld transducer) attached to the ABVS.

A 80-year-old man with a breast mass. B-mode acquisition image shows the irregularly shaped mass behind the left nipple with cross hairs placed over it, the cross hairs correlating with the mass on coronal and orthogonal reconstructions. The ABVS study shows the anatomy, mostly fat lobules, around the mass, with pectoral muscle in the deepest part of the image and the normal skin at the top. Core biopsy was performed using the handheld 18-L6 probe on the ACUSON S2000 system. The automated breast volume exam and a targeted handheld study prior to biopsy, including elastography, were assessed as BI-RADS category 5, highly suggestive of malignancy.

# Innovations in Breast Health

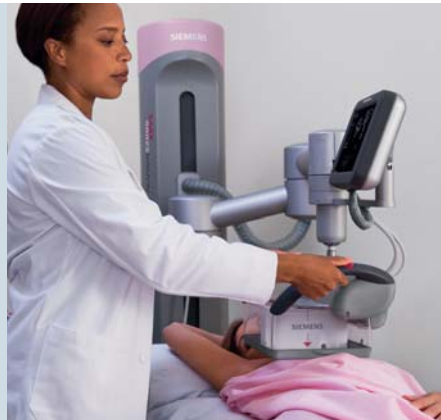
Faster imaging, superior clinical detail, shorter exams – these are all part of the new generation of breast care. Diverse imaging solutions from Siemens combine laboratory diagnostics, advanced imaging, and information technologies to help physicians detect, diagnose, and treat breast cancer earlier, faster,

and with greater precision. When the situation calls for excellent image quality and optimal access for biopsy, physicians and radiographers can rely on Siemens' renowned technology to help improve diagnostic confidence and provide better patient care.



## Digital Mammography

MAMMOMAT® Inspiration<sup>1</sup> is a highly flexible mammography platform for screening, diagnostics, and stereotactic biopsy. It increases diagnostic efficiency and confidence and makes possible a significant improvement in the early detection rate of breast cancer. It was designed with a constant focus on keeping workflow as easy and simple as possible. Its intelligent, ergonomic concept and intuitive operability make stereotactic biopsy a fast, straightforward, and user-friendly procedure. Biopsy images have the same image quality as regular mammography images, which boosts efficiency even further. MAMMOMAT Inspiration is the first mammography system to incorporate MoodLight, an LED glass panel that can be illuminated with freely selectable colors, producing a comfortable, relaxing effect. The upcoming technology breast tomosynthesis<sup>2</sup> will allow several views of the breast to be acquired from different angles. Slice images are reconstructed into a 3D volume set, providing increased visibility and higher diagnostic confidence by reducing tissue overlap – a factor that may help avoid an unnecessary biopsy.



## Automated Breast Volume Scanning

The ACUSON S2000™ Automated Breast Volume Scanner (ABVS) is a highly advanced, multipurpose ultrasound system ideally suited to comfortably image patients with radiographically dense breast tissue or a history of breast disease. In less than 15 minutes, the automated system acquires full-field volumes of the breast, provides efficient and comprehensive analysis of the 3D data, and facilitates easy, semi-automated reporting. The ACUSON S2000 ABVS offers an innovative, mobile, in-suite design to accommodate virtually any environment – from dedicated breast centers to radiology departments, clinics, and private practices. Built on next-generation acoustic technologies, the ACUSON S2000 ABVS enables never-before-seen detail resolution and the ability to acquire the unique anatomical coronal plane not available using conventional ultrasound. In addition, the system supports advanced handheld, high-resolution ultrasound capabilities for biopsy guidance, color Doppler imaging, and the latest sophisticated breast applications, including eSie Touch™ elasticity imaging and fatty tissue imaging.



## Magnetic Resonance Imaging

Introduced last year, MAGNETOM® Espree – Pink is Siemens' latest innovation in breast magnetic resonance imaging (MRI). With its optimized applications, the system allows clinicians to see more, by improving accuracy and showing more details. The system can position the patient head- or feet-first and provides excellent access to perform biopsies. Additionally, both the 70-centimeter open bore scanner and the breast coil Sentinelle Vanguard offer an exceptional level of patient comfort, even for obese and claustrophobic patients. Sentinelle Vanguard is designed with variable coil geometry that not only allows accommodation of a wide range of patient sizes, but also increases signal-to-noise ratio, ultimately delivering excellent image quality. The dedicated workplace includes syngo® BreVis for flexible reading and reporting and syngo BreVis Biopsy for fast and accurate MRI breast biopsy workflow with automatic calculation of target coordinates. The syngo BreVis Biopsy user interface offers a guide for MRI interventional planning and supports breast biopsies. The easy-to-handle workflow enables shorter examination times.

<sup>1</sup> Device not yet available in the U.S., PMA under review

<sup>2</sup> Caution: Investigational technology. Limited by U.S. Federal Law to investigational use.

detect cancers, particularly in women with dense breasts," she says. "You can get additional data from the sonogram by looking at the marking and the shape – the morphological characteristics. The wonderful detail now available is really helpful in confidently saying this is more than likely to be malignant, or on the other hand, saying the likelihood is greater for a benign mass."

Ultrasound is changing due to the introduction of automated breast volume ultrasound and the addition of elastography imaging. Unlike conventional, hand-held ultrasound, where the user moves a transducer over the breast to obtain partial views, clinicians can now use an automated, single-sweep volume acquisition technique to scan the whole breast three-dimensionally.

"We're also looking at other things that may increase specificity," says Mendelson. "Elastography is used to assess the stiffness of a lesion or tumor. Malignancies, which are often firm, can be distinguished from softer benign masses. Elastography may help increase the specificity of breast ultrasound interpretations."

Ultrasound is often used as part of other diagnostic procedures, such as needle biopsy, when a lesion is seen on ultrasound. Mendelson says that performing needle biopsy with ultrasound guidance, "allows for real-time capability that you get with no other imaging modality. You can see and adjust and fine tune the needle approach and get good samples."

### MRI for High-risk Patients

MRI has become an integral part of breast screening, particularly for high-risk patients, according to Dr. Wenkel. These include women with a personal or family history of breast cancer, those who have undergone previous breast surgery, and those with certain inherited genetic factors. MRI is helpful in viewing breast abnormalities that can be felt but are not visible with mammography or ultrasound.

"The modality's role is growing: In cases where breast MRI is the only modality to detect the tumor, we have to offer MRI-guided biopsies to the woman to get to the histological specimen," says Wenkel.

Dr. Mendelson adds, "Increasingly, MRI is being used in the evaluation of both breasts when a patient has a new diagnosis of suspected cancer. At North-western, we do about five or six studies a day, and we do about seven biopsies a week with MRI guidance in addition to all of our interventional procedures with stereotactic guidance and with ultrasound guidance. The MRI piece is becoming extremely important in the management of cancer patients."

### On the Horizon

An exciting development still to come, digital breast tomosynthesis, is a 3D imaging technology that will take two-dimensional images and reconstruct them to reveal depth. During this imaging procedure, a machine takes a series of X-rays as it rotates around the breast. Tomosynthesis allows the breast to be viewed in many thin slices, which can be combined into a three-dimensional picture. It may allow doctors to detect smaller lesions or ones that would otherwise be hidden with standard mammograms.

The bottom line? Advanced imaging techniques play an important role in screening as well as diagnosis, and in the performance of minimally invasive breast biopsies. New and better imaging tools improve breast cancer diagnostic accuracy. For patients, the new techniques mean more comfort and reduced time, cost, and stress – and possibly, additional criteria for enabling the reduction of benign biopsies.

*Diana Smith is a freelance journalist specializing in medical topics based in Liberty Hill, Texas, USA.*

## Summary

### Challenge:

- Reduce the number of unnecessary surgical biopsies for patients with suspicious breast lesions or masses
- Decrease risk of complications for patients due to more tissue removal and necessity of anesthesia in surgical procedures
- High costs associated with OR-based surgery
- Difficulty in determining the difference between malignant and benign tumors without using surgical biopsy
- Reduce waiting time for patient results

### Solution:

- A wide range of new imaging solutions from Siemens to accurately determine whether an abnormality is cancer, providing imperative information about disease presence and which treatment options may be most effective
- Innovations in mammography, ultrasound, and MRI for increased patient comfort
- New systems that allow significantly improved access and stellar image quality when needle biopsies are indicated
- Education for physicians, clinicians, and patients about the benefits of the new imaging modalities for detection of disease
- Improved management workflow, increasing efficiency and access to information

### Result:

- Superior image quality
- Increased use of imaging or image-guided biopsies, a much less invasive procedure with fewer complications than surgical biopsies
- Optimized screening and diagnosis as standard protocol
- Less waiting time for test results
- Lower-cost diagnostic tools

### Further Information

[www.siemens.com/breastcare](http://www.siemens.com/breastcare)