

# The Next Wave in Breast Cancer Management

Laura Newman

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# The Next Wave in Breast Cancer Management

Around the world, breast cancer management is changing radically. International medical experts link the corresponding decline in breast cancer deaths to earlier detection and advanced treatment options.

By Laura Newman



Herself a one-time patient at Battlefield Auxiliary Breast Center, Barbara Robertson (standing left on top left photo) sees patients through their breast cancer journey. Modern Siemens equipment supports care – from mammography to ultrasound (top right), MRI (bottom left), biopsies (bottom right), and PET-CT (previous page).

The radiology suite is moving towards a completely digitized environment, with the best offering integrated imaging systems that span the clinical, operational, and financial workflow. Siemens now has more than ten innovative breast imaging and treatment solutions for improved diagnosis, better localization of lesions, targeted treatment, and long-term monitoring. The following article takes a comprehensive look at current innovations and new developments on the horizon.

## Leading the Fight

Barbara Robertson finally got her diagnosis of breast cancer in 2004. Her story shows why her diagnosis was delayed until she underwent breast magnetic resonance imaging (MRI) with Siemens Open Bore MRI scanner MAGNETOM® Espree.

In 1999, when she felt pain in her stomach and had difficulty eating, Robertson sought medical help. She was told that she had inoperable stomach cancer and that she had between four and six months to live. At that time, she was 64 years of age. She chose no chemotherapy, no radiation, and no surgery. Fortunately, her daughter was in the medical field and together, they sought a second opinion. Eventually, Robertson learned that breast cancer can mimic stomach cancer, and that her primary tumor was in the breast. "The breast cancer was not seen on mammography or ultrasound," she explains. "It was only seen on MRI." In the time since her first diagnosis, her tumor had spread beyond the stomach, to the bones, and recently, to the bladder.

It is possible that, had today's comprehensive imaging solutions such as breast MRI been available earlier, Robertson's breast cancer might have been detected sooner, when it was more curable and less likely to spread. With today's technology, the door might have swung open to more effective treatment for her.

Siemens MAMMOMAT® *Novation*<sup>DR</sup> full-field digital mammography machine is more accurate than analog machines in dense breasts, premenopausal and women under 50, and it also delivers only half the radiation. Therefore, it enables better detection of breast cancers in these patients during initial evaluation or annual mammograms\*. In addition, today's ultra-

sound Elasticity Imaging can be effective after an unclear mammogram and conventional ultrasound. Lately, Elasticity Imaging has emerged as a sensitive and accurate method that more clearly demonstrates relative tissue stiffness or hardness.

## Arriving at the Right Diagnosis

Robertson received her accurate diagnosis at Battlefield Auxiliary Breast Center in Ringgold, GA, USA. When Battlefield asked for volunteers to undergo breast MRI, more than 200 women responded. Robertson gladly became the first case. "It was only with this breast MRI that my breast cancer was picked up," she says. "You can't imagine how well they treat people here – the staff is so nice and courteous – and what a good feeling it is to know that you are being diagnosed with the most current tests." Robertson says she feels indebted to the center for her excellent care and volunteers there two days a week. At age 72, she reflects on her experience: "I think that this is my calling – to be right here at Battlefield and support women as they go through their journey. As long as I can keep doing it, I am going to do it." Battlefield's Director, Barbara Marshall, RT, in turn, says the center is indebted to Robertson: "She gives her heart and soul to this place."

Battlefield Auxiliary Breast Center is part of Hutcheson Medical Center. It opened its doors in 2004. John F. Nelson, MD, the center's Medical Director, describes it as a "bread-and-butter community imaging center." He says it was five years in the making, and has now been three years in operation. Breast cancer survivors helped design the space and its patient amenities at Battlefield. Dedicating a separate space for women's health imaging away from the rest of the center offers women the privacy they need. Placing all breast imaging services under one roof, with each modality housed in close proximity, has made it easy for patients to navigate from one test to another. Center staff and volunteers are proud of their comfortable waiting rooms, relaxed and private areas to discuss results, and the fact that they provide patients with nontraditional, patterned robes during their visit – which, thanks to the efficient Siemens equipment, is usually brief.

Located in the northeastern corner of Georgia, it was the first center in the tri-

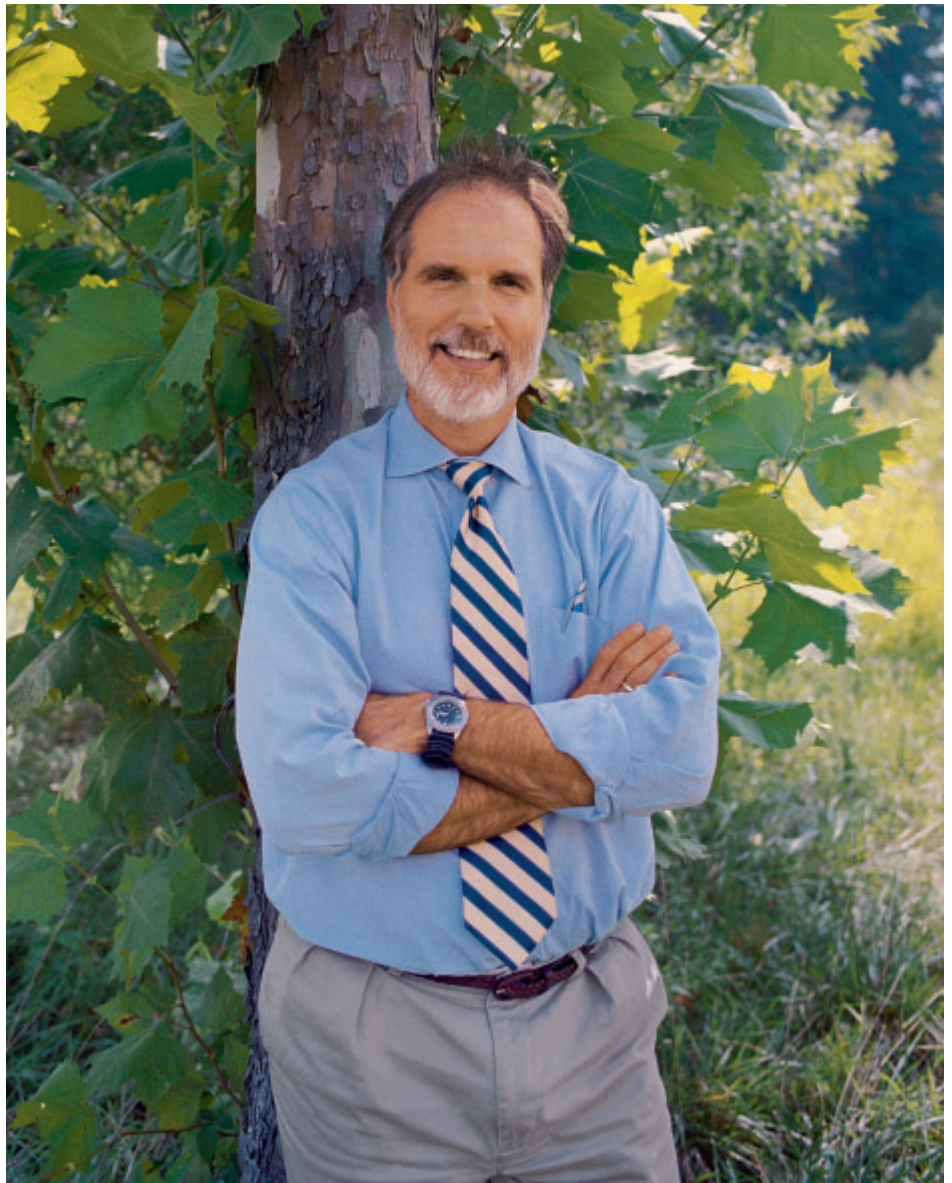
**“You can't imagine how well they treat people here and what a good feeling it is to know that you are being diagnosed with the most current tests.”**

Barbara Robertson, Patient and Volunteer,  
Battlefield Auxiliary Breast Center,  
Ringgold, GA, USA

\* Pisano et al., Diagnostic Performance of Digital versus Film Mammography for Breast-Cancer Screening, *N Engl J Med.* 2005;353.

“The time that we are able to dedicate to patient care is greatly owed to the fast and easy workflow at the systems themselves as well as when reading images and dictating results.”

John F. Nelson, MD, Medical Director,  
Battlefield Imaging, Ringgold, GA, USA



Offering a panoply of the latest imaging modalities is crucial for optimizing breast cancer care, according to Dr. Nelson.

state (Georgia, Tennessee, South Carolina) area to offer full-field digital mammography and to embrace digitized imaging. Center Director Marshall credits a strong collaboration with Siemens as enabling Battlefield to stay out front. “They have always been supportive, and we have a mutually beneficial arrangement,” she says. Owning MAMMOMAT *Novation* has proved an important marketing tool, according to Nelson.

“Women realize that this is an up-to-date and accurate mammography system, and they no longer have to drive to Chattanooga [Tennessee] or Atlanta [Georgia].” The availability of cutting-edge imaging and tender loving care has also attracted

women throughout the tri-state area, as well as Alabama, he adds. “Everybody comes here – mothers, grandmothers, daughters.” Both Nelson and Marshall credit a solid collaboration with Siemens and their excellent staff – including a large number of volunteers like Barbara Robertson – for making the facility a leader in breast care.

Nelson realizes that offering a panoply of the latest imaging modalities is crucial for optimizing screening, diagnosis and staging, treatment, and monitoring. It is also essential for Battlefield’s continued success. Center administrators are proud to be the first community center in their area to have the MAGNETOM Espree Open

Bore MRI system with Tim® (Total imaging matrix) technology. Other equipment includes a *syngo*® Opdimax upright stereotactic biopsy system, an ACUSON Sequoia™ ultrasound system, and a Biograph™ TruePoint™ PET·CT (positron emission tomography-computed tomography) scanner. According to Nelson, use of the MRI scanner has soared so much that the center is adding another Siemens system, the brand-new MAGNETOM Essenza, where Battlefield continues to be an early adopter of state-of-the-art technology. He foresees an expanding role for breast MRI in the context of evaluating women who are premenopausal, have dense breasts, have a strong family history of breast cancer,

and are among those who test positive for the BRCA1/BRCA2 gene mutations.

### Accelerated Workflow

Battlefield's administration sees added benefits to collaborating with Siemens for a comprehensive solution for breast cancer screening, detection, and follow-up. Having patient data linked with Siemens *syngo* Suite radiology information system (RIS) and picture archiving and communication system (PACS) solution has resulted in numerous efficiencies, for example, in scheduling patients, performing the examination, interpretation, reporting, and archiving of patient data, including examinations performed on different modalities like ultrasound in the same database, according to Barbara Marshall. "Information for each modality is easily entered into the system, and it is ready to be downloaded at any workstation," she says, adding that workflow is also improved by the fact that all of the systems are positioned near each other, off the same corridor. The new imaging devices are both more comfortable for patients and easier to work with for staff, and the timesaving factor is significant. "The time that we are able to dedicate to patient care is greatly owed to the fast and easy workflow at the systems themselves as well as when reading images and dictating results," Nelson says. At the October 2007 American Society for Therapeutic and Radiation Oncology (ASTRO) Annual Meeting, *Outpatient Care Technology* named Battlefield one of the nation's Top Imaging Centers of Excellence for the year. What made the center an award-winning facility in just three years was its rapid adoption of the newest and best breast imaging equipment available, its caring staff, and its solid collaboration with Siemens.

Before the center opened, says Marshall, "We have a vision – taking women through the journey from discovery to recovery, touching one life at a time. We wanted the center to be a spa-like setting." She does not talk about patient satisfaction, but rather sets a higher bar: patient loyalty. With early detection helping to reduce the need for long-time therapeutic treatment – allowing many women diagnosed with cancer to avoid pain and suffering and continue to lead happy, productive lives – the Battlefield team should have an attainable goal.

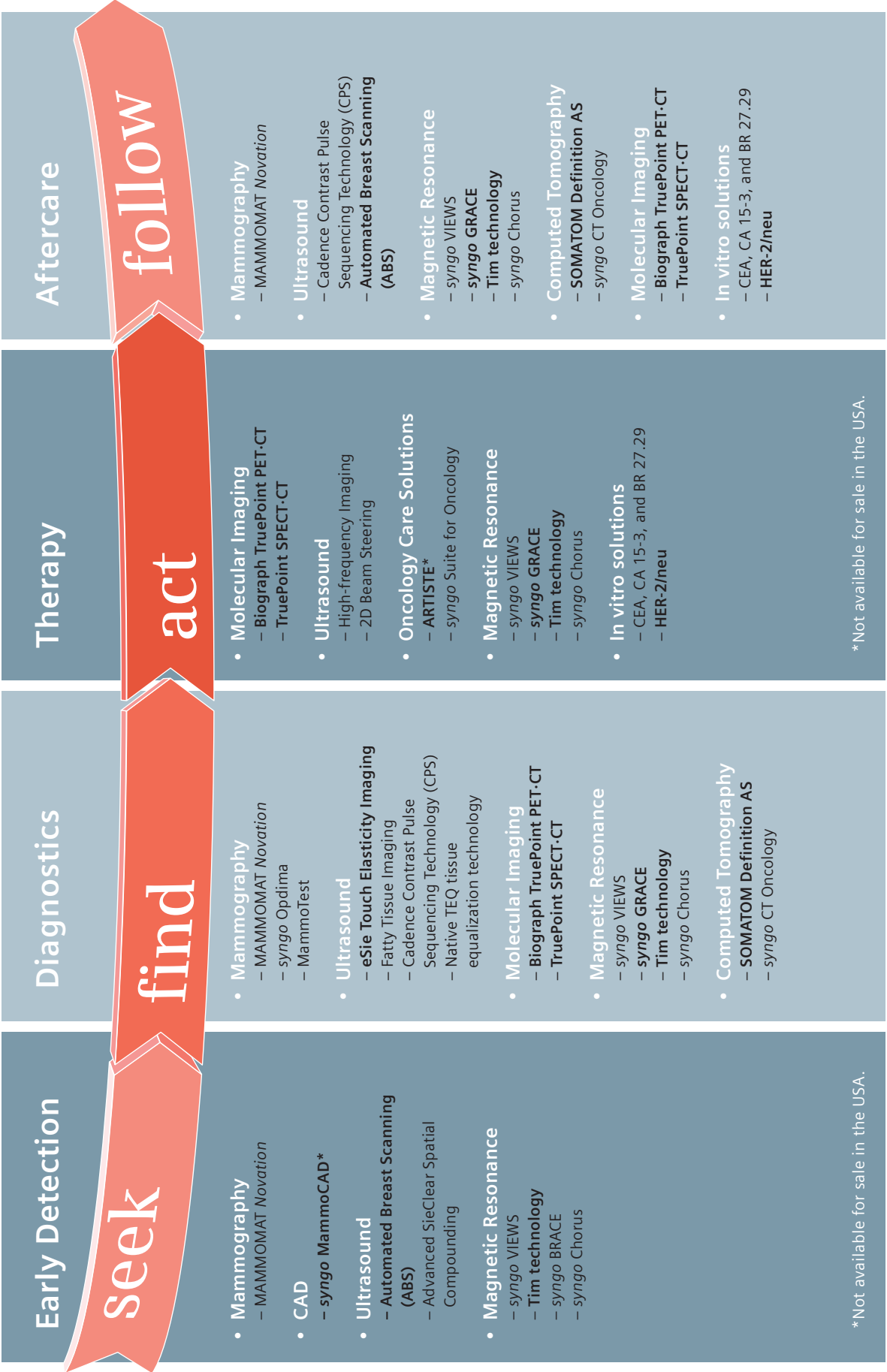
*Continued on page 35*

**“We have a vision – taking women through the journey from discovery to recovery, touching one life at a time.”**

Barbara Marshall, RT, Director, Battlefield Imaging, Ringgold, GA, USA



For Barbara Marshall, excellent staff, including a large number of volunteers, is key to providing patient-centered care.



\*Not available for sale in the USA.

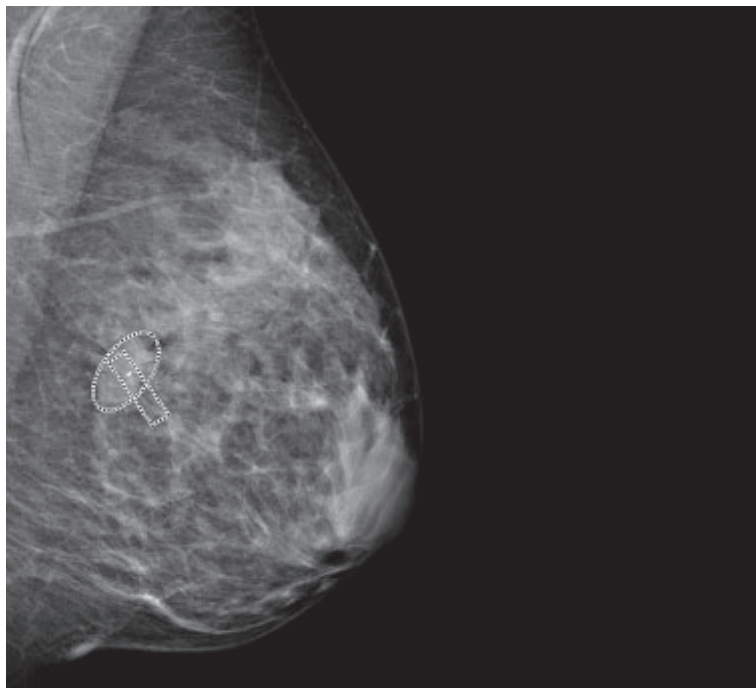
\*Not available for sale in the USA.

Medical experts from the USA, Germany, Belgium, France, Netherlands, and Japan talk about the latest Siemens innovations for breast cancer.

DETECTION / seek

## CAD in Mammography

Computer-aided detection (CAD) software offers radiologists a second look at lesions that might otherwise be missed on full-field digital mammography. CAD algorithms are written to identify specific cancer morphologies. It can minimize mistakes in interpretation when radiologists tire from reviewing mammograms repetitively. The advantage of CAD is that it flags areas of concern for a radiologist to reexamine. Tommy E. Cupples, MD, a private practice radiologist at ImageCare in Columbia, SC, USA, has been a leading proponent of CAD. According to Cupples, CAD can direct the radiologist's attention to possible areas of concern, but it cannot establish the diagnosis. "It still remains up to the radiologist to determine whether or not the CAD finding is 'actionable,'" he says. And in that sense, he explains, the technology is only as good as the accuracy of the mammographer. Where he has found CAD to be especially valuable is in flagging small, early-stage lesions, and lesions in younger women. "These are the ones that are most likely to be overlooked and where CAD makes the most difference," says Cupples.

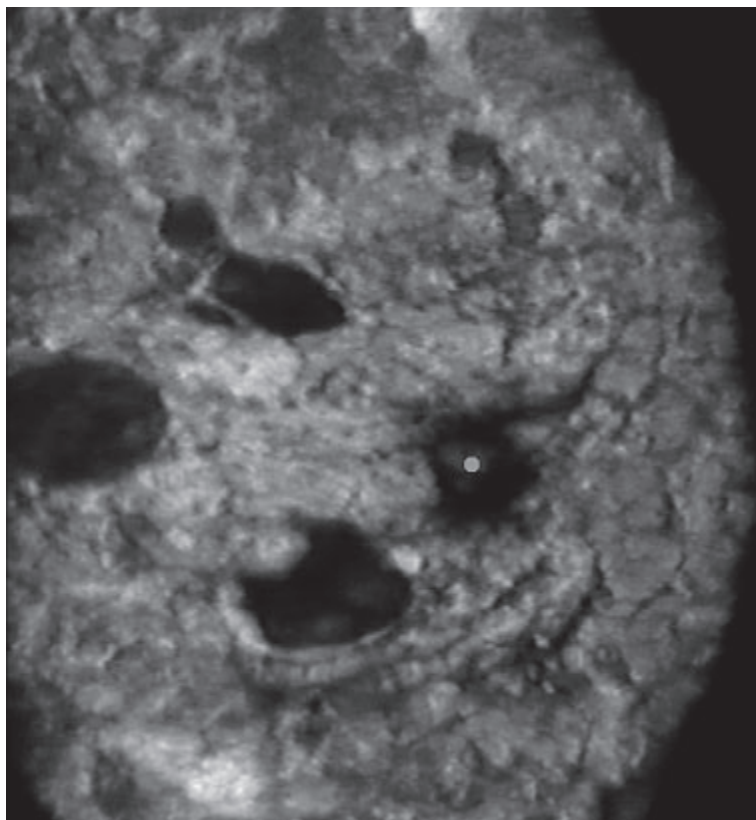


syngo MammoCAD\* marking a suspicious lesion for further review – a mass and a cluster of microcalcifications

\* Not available for sale in the USA.

## Automated Breast Scanning (ABS)

Operator dependency is a great issue in ultrasound, but with the addition of U-Systems, Inc., SomoVu™ Automated Breast Ultrasound System, it could soon be overcome. SomoVu breaks new ground in its ability to visualize dense breast tissue. The system produces standardized, reproducible 2D and 3D images. Workflow improvements in patient care, as well as operational and financial aspects are substantial, according to André-Robert Grivegnée, MD, who has been using the scanner for about a year. Its automation feature cuts nurse and physician time in half, notes Grivegnée, Professor and Clinical Chief of Breast Imaging at the Institut Jules Bordet in Brussels, Belgium. "With conventional ultrasound, it takes physicians between ten and 15 minutes to do a scan; it takes less than five minutes with SomoVu," he says. "Now, we can do six scans per hour instead of three to four." The improved patient workflow leaves more time for patient care as well. "Patients like SomoVu because there is less compression, just contact on the skin, and they don't perceive the exam as aggressive," says Grivegnée. Another advantage, he notes, is that all of the data are stored, allowing radiologists to review the information later.



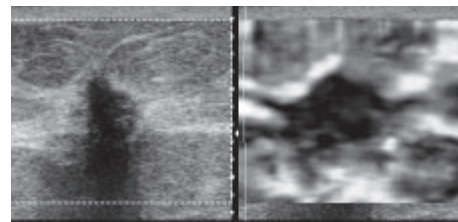
Coronal view of a breast cyst identified with SomoVu Automated Breast Ultrasound System distributed by Siemens

## Elasticity Imaging

Much research and development in breast imaging is geared toward developing devices that offer increased specificity. eSie Touch™ Elasticity Imaging is a promising, novel technique under study. Richard G. Barr, MD, PhD, Professor of Radiology at the Northeastern Ohio University College of Medicine and Radiologist at the Southwoods X-Ray and MRI in Youngstown, OH, USA, describes how it works. "An elastogram differentiates relative hardness and softness of tissue," he explains. "Initial findings indicate that elasticity technology has

high specificity for the investigation of breast lesions. It uses normal respiration and movement to monitor changes in the shape of tissues with movement, and it is fairly easy to perform." The technique is a software modification of a routine ultrasound exam, yet with no noticeable difference to the patient, while still offering diagnostic confidence to both the physician and the patient.

A preliminary study of Siemens eSie Touch imaging software conducted by Barr revealed an extremely high specificity. Elasticity Imaging was tested in a population of 80 patients with 123 suspicious lesions. It correctly identified 17 of 17 malignancies. It predicted 105 of 106 benign lesions. If these findings are validated in a larger trial, Barr anticipates that Elasticity Imaging will become an



Biopsy-proven invasive ductal carcinoma as detected with eSie Touch Elasticity Imaging – area of stiffness in black

adjunct to other breast imaging techniques. Currently, a multicenter trial is underway at three facilities located in Europe (London, Paris), Australia (Brisbane), and several sites in the USA.

## Breast Spectroscopy, *syngo* GRACE

Walk into breast imaging centers around the world and one of the first things you notice is the expanded use of breast MRI. Since the publication of a March 29, 2007 article in *The New England Journal of Medicine* that showed how breast MRI helped detect cancer in the contralateral breast that was missed with mammography, more facilities have become interested in this modality, especially for high-risk women. In the meantime, new American Cancer Society guidelines advise using breast MRI for high-risk women, including those with BRCA1 or BRCA2 mutations. Mitsuhiro Tozaki, MD, Director of the Breast

Center at Kameda Medical Center, Chiba, Japan, supports that indication: "MRI is a very sensitive modality. The results are compelling."

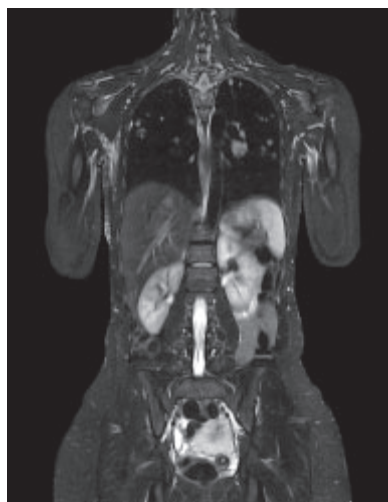
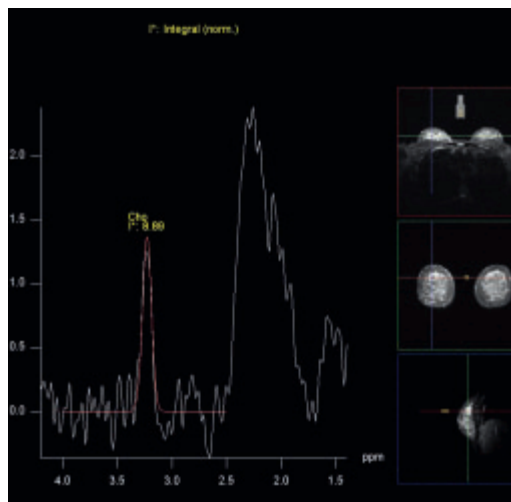
Recent studies now suggest that when breast MRI spectroscopy is added to conventional breast MRI, specificity increases to nearly 90 percent. Dr. Tozaki has imaged 1,500 patients with breast MRI and 700 patients with the Siemens breast spectroscopy application *syngo*® GRACE.

With *syngo* GRACE, choline can be detected in breast cancers, which is considered an indicator of the activity of breast neoplasms and the viability of breast cancers.

Therefore, Siemens breast MRI spectroscopy, *syngo* GRACE, shows great promise as a way to differentiate between benign and malign lesions, and to gauge the effect of chemotherapeutic agents in patients with locally advanced breast cancer.

Tim® technology adds further benefits to MRI imaging in breast cancer patients: Thanks to its automated coil selection, breast spectroscopy and a whole-body exam for metastases can be done in one exam, without patient or coil repositioning.

"Spectroscopy acquisition takes between five and seven minutes, whole-body imaging with MRI 35 minutes, and for MRI plus MRI spectroscopy, it's 40 minutes. Acquisition with Tim is totally automatic," Tozaki says. "I am also very positive about using MRI after chemotherapy for monitoring."



Left: *syngo* GRACE breast spectroscopy including choline quantification

Right: Lobular Cancer with lung metastasis and axillary lymph nodes  
Courtesy of: First Hill Diagnostic Imaging Center, Seattle, WA, USA

## PET-MRI: Improving MRI Specificity

Setting out to improve the specificity of breast MRI is a major objective of ongoing breast cancer research. Ideally, with increased specificity, women could be spared invasive procedures, such as biopsy, fine needle aspiration, or resection.

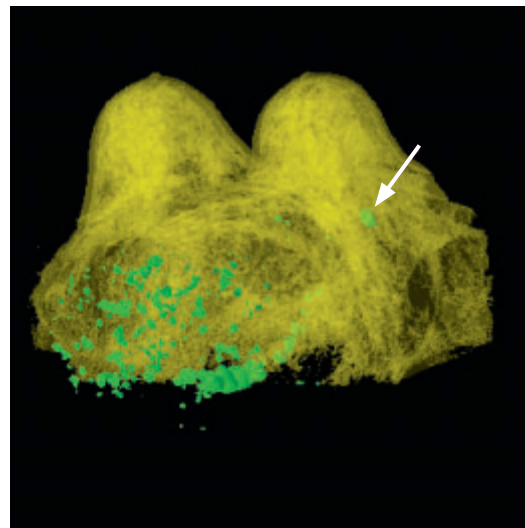
Linda Moy, MD, Marilyn Noz, PhD, and colleagues at New York University School of Medicine's Department of Radiology, have been evaluating whether images from Siemens PET-CT, when fused with MRI images from the department's Siemens MRI systems, yield added specificity to breast MRI. For the PET exam, they used a prototype prone positioning device. So far, fusing prone PET scans with standard breast MRI scans has demonstrated increased specificity.

Dr. Noz reports that her fusion results have been quite good. "MRI gives you localization, and PET picks up the FDG [<sup>18</sup>F-fluorodesoxyglucose]," she says. "Standard supine acquisition PET is useful for staging distant metastases, but is less adequate in breast tissue

itself. Using MRI alone, the specificity was about 50 percent, but when combined with prone PET, the specificity rose to 95 percent."

The prototype device allows patients to be imaged by PET in the prone position as is customary with MRI scans. In a preliminary study of 45 lesions in 22 patients, sensitivity and specificity for MRI were 92 percent and 52 percent respectively. When MRI and PET were fused, the sensitivity declined to 83 percent, while specificity increased to 95 percent. An additional 14 patients have been studied since, and the pooled analysis confirms the initial results.

Patient shown in 3D with arrow indicating a two-centimeter lesion confirmed as moderately differentiated invasive ductal carcinoma. Yellow, shown transparent, is the MRI scan; the fused PET lesion and other high-activity regions are superimposed in green. Lesion is inside left breast, whereas the other high activity regions are in front of and beneath the MRI scan.

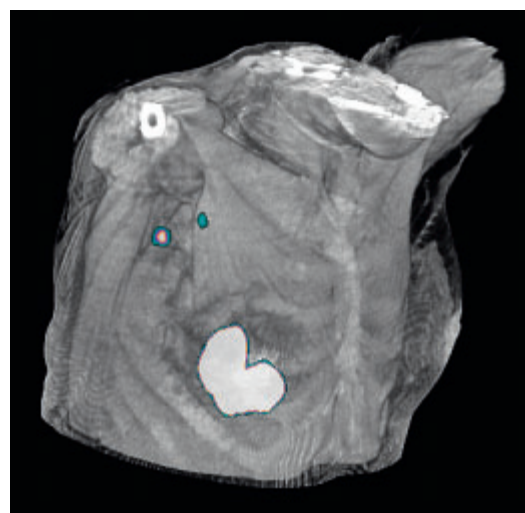


## Lymphoscintigraphy

When Homer Macapinlac, MD, is asked if he thinks the future of breast imaging rests on hybrid technologies, he answers emphatically: "Once you drive a Lexus, you can't go back to a [Toyota] Camry...it's like night and day." Macapinlac, Professor and Chairman of Nuclear Imaging at MD Anderson Cancer Center in Houston, TX, USA, has been conducting lymphoscintigraphy research on Siemens Symbia® TruePoint™ SPECT-CT, (single photon emission computed tomography-computed tomography) used for pretreatment planning in breast sentinel lymph node excision. MD Anderson Cancer Center was one of the first facilities that acquired the hybrid system.

"What's novel about it is that you perform two exams in the same sitting – we can acquire the CT scan right after the SPECT and fuse the image," he explains. "The result is more precise localization of the node, which CT alone does not offer. Here, we call it 'SPECT-ACULAR-CT.'"

Symbia accelerates workflow in several ways, according to Macapinlac. Eliminating multiple sittings is a significant time saver. Offering surgeons the ability to see the lymph nodes draining on the fused image gives them added anatomic information and helps them find the lymph nodes faster; surgery becomes easier to perform, time in surgery is shortened, and patients spend less time under anesthesia. Even though Macapinlac is impressed by early results, he emphasizes that before Symbia is widely adopted for breast lymphoscintigraphy SPECT-CT imaging, further research is imperative.

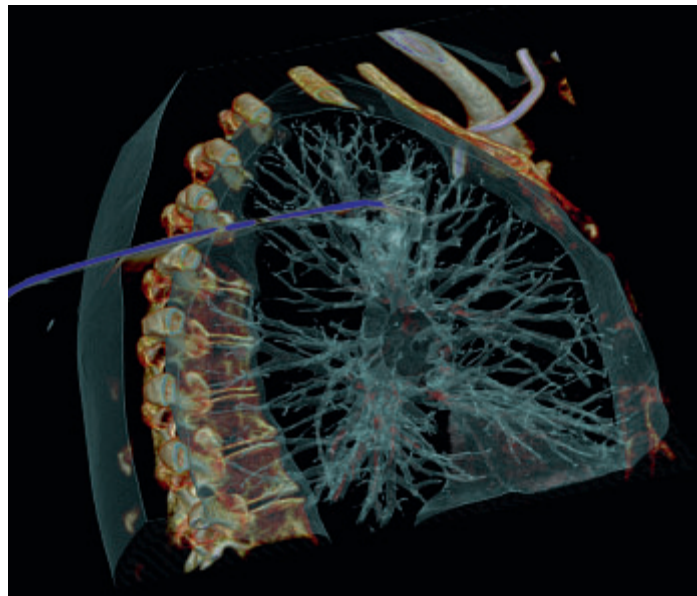


<sup>99m</sup>Tc-Sulfur Colloid SPECT-CT lymphoscintigraphy performed on a patient with primary breast carcinoma accurately localizes two sentinel lymph nodes in the axilla for further biopsy.

## Staging with SOMATOM Definition AS

Superior engineering, enhanced workflow, and, above all, more precise tissue characterization are features that distinguish the SOMATOM® Definition AS\* scanner from other computed tomography (CT) systems on the market. As the world's first adaptive scanner, "It can provide a reliable diagnosis for virtually any clinical question," says Werner Bautz, MD, Professor of Radiology and Medical Director at the University Hospital of Friedrich-Alexander University in Erlangen, Germany. In the setting of breast cancer, the innovative scanner is particularly valuable for staging lymph node involvement, as well as lung, liver, and bone metastases. Thanks to its 78-centimeter gantry bore, it is also perfectly suited for CT-guided ablation therapy procedures. Bautz notes that the new system's features raise the bar for the industry. "Acquisition takes only a couple of seconds, and the entire diagnostic workflow is faster," he says. SOMATOM Definition AS works with the *syngo*® CT Oncology (see page 70) and *syngo* WebSpace (see page 46) follow-up and workflow solutions. Thanks to the first, "You can tell whether the treatment is working or not right away because you can automatically track changes in tumor volume," says Bautz. And with *syngo* WebSpace, "Images can be viewed with a single mouse click at any computer with Internet access," for example, when getting a second physician's opinion.

\* Status at editorial deadline: The information about this product is being provided for planning purposes. The product is pending 510(k) review and is not yet commercially available in the USA.



CT-guided ablation therapy for a metastatic lung lesion

### THERAPY / act



## Serum Tests: HER-2/neu

Siemens Medical Solutions Diagnostics is bringing medical oncologists an HER-2/neu serum biomarker test for monitoring metastatic breast cancer. Professor Jean-Pierre Lotz, MD, Chief Medical Oncologist at Université Pierre et Marie Curie's Hôpital Tenon in Paris, France, said that he began studying the serum test five years ago, at the directive of the French Ministry of Health.

The serum test measures circulating HER-2/neu extracellular domain (ECD); longitudinal changes in serum levels reflect the effectiveness of treatment. Lotz says that baseline serum tests are necessary to see longitudinal changes, which could

guide therapy. "My first experiences with measuring serum HER-2/neu for metastatic breast cancer showed that after patients were given chemotherapy, if the treatment was working, serum levels would rapidly decrease in the first three to four weeks after treatment," says Lotz. "We confirmed our serum readings with a CT scan." Christine Druther, MSPH, breast cancer survivor and founder of the HER-2 Support Group, calls it a "wonderful" test that monitors progression when other serum tests, such as CA15-3 and CA-125, fail. "People who are not getting it are being underserved," says Druther.

The serum HER-2/neu test is an FDA-cleared blood test to help doctors monitor changes in the serum HER-2/neu levels and to manage the therapy of women with metastatic breast cancer.

## Adaptive Radiation Therapy

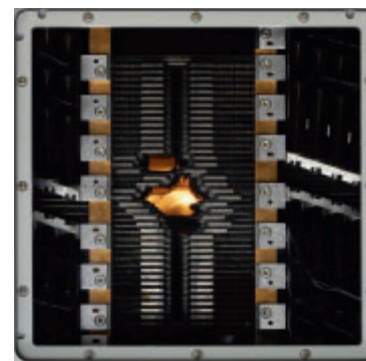
Adaptive Radiation Therapy (ART) is designed to provide feedback to the radiation oncologist immediately before or during treatment so therapy can be adapted to anatomical changes and shifts in patient positioning. A primary goal of ART is to ensure that the therapeutic dose is delivered precisely to the target and that surrounding healthy tissue is spared as planned. This is especially important with breast irradiation, because the breasts are close to the heart and lungs.

Professor Philippe Lambin, MD, Head of the Department of Radiation Oncology at MAASTRO Clinic in Maastricht, Netherlands, is impressed with the ARTISTE™\* Solution from Siemens, the next generation in ART. "You are able to set up the beam so that the heart and lungs are not

in the radiation field," he says. Innovative In-Line™ imaging technology allows clinicians to tailor radiation therapy to the patient's changing anatomy.

"With entrance-and-exit dosimetry, you know precisely where in each part of the body the dose is," explains Lambin. "An advantage of ARTISTE is that the system images in the axis of the beam, not perpendicular to the beam. The image quality is much better. This has really changed physician quality control."

Additional features that Lambin finds appealing are its flexibility in working with Image-Guided Radiation Therapy (IGRT). "Given ARTISTE's built-in flexibility," he says, "we do not need to immobilize the patient with a special frame for stereotactic radiotherapy." Lambin adds that molecular and



Providing accurate dose distribution, the 160 MLC™ Multileaf Collimator is a standard feature on the ARTISTE Solution.

functional imaging will be the next hurdle to overcome. "Radiation therapy has been given in a homogeneous fashion, and we know tumors are not homogeneous." Today, together with Siemens, his clinic is at the forefront of this research, and is forging a new path in ART.

\* Not available for sale in the USA.

*Continuation from page 29*

## Looking Forward, Looking Back

When radiologists in the future look back on the evolution of breast imaging within the last 40 years, they will see that mammography opened an entirely new field. Analog mammography was the first imaging tool demonstrated to save lives, and it remained the cornerstone of breast screening for years to come. The outlook for breast cancer patients would be forever changed – early detection proved an achievable goal. Eventually, though, the limitations of analog mammography caught up with it: There was a high false-negative rate and difficulty imaging young women and those with dense breast tissue. Mammography's functionality was also limited. Women disliked its harsh compression, and workflow was laborious. Responding to the need to overcome these drawbacks and move breast imaging towards the next generation, they will see that Siemens and its research collaborators and customers have stepped up to the plate to develop new solutions in this critical area of healthcare. As a result, today's screening systems are less intimidating for the patient, yet they offer far

better tissue characterization and more specific staging, in addition to providing improved patient surveillance.

Who would have envisioned that digital mammography, MRI, and ultrasound would eventually be recommended as standards of breast cancer screening and care, even at a community imaging center? Dr. Nelson says that offering the most advanced imaging technology has been a key to making the 'journey' for his patients a little easier, and has resulted in building a larger patient base, assuring patient loyalty, and streamlining workflow to free time for patient care. It has also had a positive effect on the bottom line: Early adoption of these devices has paid for itself quickly, according to Nelson.

Today, Siemens is working with several collaborators around the world to develop all-in-one breast care solutions that enhance patient, operational, and financial results. Comprehensive imaging solutions also have unprecedented flexibility and functionality. Siemens has also diversified its breast care capabilities far beyond adding greater specificity to breast cancer

screening. Hybrid devices, such as Symbia® TruePoint™ SPECT·CT, build on the strengths of their individual components, evaluating distant metastases and using imaging for more targeted and safer treatment planning. Beckoning on the horizon are individualized treatments, such as the Siemens ARTISTE™ Adaptive Radiation Therapy solution, as well as molecular and functional imaging. All of these developments point to a future that looks brighter than ever in the fight against breast cancer.

*Laura Newman is an award-winning medical writer based in New York, NY, USA. She is the author of numerous feature articles about emerging medical technologies. She was also the editor of Medical Outcomes & Guidelines Alert, a newsletter widely read by the pharmaceutical and medical device industry.*

### Further Information

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