Increased Diagnostic Confidence with 3.0T MR for Breast Imaging

Jeffrey Weinreb, M.D., FACR, believes the future of Breast MRI belongs to 3.0T MR technology. Dr. Weinreb, Chief of MRI and Director of Medical Imaging Services at Yale New Haven Hospital, uses the GE Signa® HDx 3.0T system extensively for breast studies and finds that it sometimes provides information that is useful in making a diagnosis. In some cases, its higher spatial resolution provides crucial information that is not attainable at 1.5T.

Stepping Up to 3.0T

Since the early 1990s, Dr. Weinreb has collaborated with mammographers and pathologists on diagnoses. He regards MR as a valuable complement to mammography screening and ultrasound examinations that can reveal areas of suspicion.

"We use MR for women who are at high risk because they have a genetic predisposition or a strong family history of breast cancer, have had breast cancer before or received radiation treatment for Hodgkin's disease," said Dr. Weinreb.

In 2005, Yale New Haven Hospital installed the GE Signa HDx 3.0T MR system, adding to a department that already included four Signa 1.5T MR systems. The Signa HDx 3.0T scanner – the latest in MR technology – is equipped with High Definition (HD) technology, such as the GE HD 8-channel breast coil and VIBRANT,™ an exclusive GE application that enables fast, high-resolution bilateral breast imaging. GE's complete Breast MRI solution, which also includes a breast-specific spectroscopy application, BREASE,™ and through a unique integration with Confirma,™ Inc.'s (Kirkland, WA) industry-leading CAD analysis product, CADstream,™ is unmatched in the industry.

Bilateral imaging saves patients the inconvenience of having two separate Breast MRI exams. For clinicians, it eliminates the need to choose between scanning for structural detail and scanning rapidly for uptake information. It provides rapid imaging without compromising in-plane resolution. VIBRANT also allows the choice of direct sagittal or axial imaging and automatically optimizes parameters, making it easy for technologists to deliver consistent image quality. Specifically, a strength of VIBRANT is a unique bilateral shim method, which results in homogenous fat suppression over both breasts.

"Having worked in Breast MRI using 1.5T scanners for about 15 years, I had a good idea what the capabilities and limitations were," Dr. Weinreb explained. "With the added signal and other capabilities of 3.0T, I believed we could move Breast MRI to a higher level. We have translated the higher signal strength of 3.0T into higher spatial resolution, which enables us to see finer detail in the images.

"I can't say it increases diagnostic confidence on every single case. But we certainly have had cases where at 1.5T we were not quite sure what we were dealing with, and 3.0T definitely gave us additional confidence."

Seeing Both Sides in One Exam

Dr. Weinreb prefers bilateral breast studies and finds the VIBRANT application extremely helpful. "In the past, bilateral exams were technically challenging, because it was difficult to get uniform fat suppression over both breasts," he said. With VIBRANT and bilateral shimming, it is no longer a challenge to achieve uniform fat suppression. This has tremendous value versus other breast MR imaging applications in the industry.

VIBRANT is a 3D, fat-suppressed, T1-weighted technique used for dynamic scans. "With VIBRANT, we can get good, uniform fat suppression across the entire field of view," Dr. Weinreb added. "There are two benefits of a bilateral exam. First, we can find suspicious areas in the other breast that were totally unsuspected. Second, we can compare the breasts. Symmetry is very important. We might see something in one breast that looks suspicious, but if we see exactly the same thing in the other breast, our suspicion drops significantly."

The typical protocol for 3.0T breast studies is to perform a T2-weighted, fat-suppressed scan in the sagittal or axial plane, then a series of T1-weighted non-fat-suppressed images. "We do that because, very commonly, there are little enhancing nodules in the breast," Dr. Weinreb explained. "They can enhance very intensely, and we don't know if they're benign or malignant. With the non-fat-suppressed T1-weighted images, if we see bright fat in that nodule, we know it's an intra mammary lymph node and we don't have to worry about it. That has prevented us from recommending unnecessary biopsy in a lot of patients.

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Dr. Jeffrey Weinreb

Jeffrey Weinreb, M.D., FACR

Jeffrey C. Weinreb, M.D., FACR, is Professor of Diagnostic Radiology at Yale University School of Medicine and Director of Medical Imaging, Chief of Body Imaging and Chief of Magnetic Resonance Imaging (MRI) at Yale-New Haven Hospital (New Haven, CT). He is a fellow of the American College of Radiology (ACR) and the International Society of Magnetic Resonance in Medicine, President of the Society of Computed Tomography/MR, Vice President of the ACR, and has held various editorial positions for radiology and MRI journals.

Dr. Weinreb specializes in Body MRI and CT with research interests for MR imaging in liver, breast, and prostate. After graduating from the Massachusetts Institute of Technology, he received his medical degree from the Mount Sinai School of Medicine. He completed his postdoctoral training in radiology at Long Island Jewish Medical Center and received fellowship training at the Hospital of the University of Pennsylvania.

About Yale-New Haven Hospital, New Haven, CT

Yale-New Haven Hospital (YNHH) is a 944-bed tertiary referral center, which includes the 201-bed Yale-New Haven Children's Hospital and the 76-bed Yale-New Haven Psychiatric Hospital. The primary teaching hospital for Yale University School of Medicine (YSM), Yale-New Haven's medical staff is enhanced by 471 supervised house staff physicians (residents) who add around-the-clock coverage and sharp inquisitive minds to patient care.

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Dr. Jeffrey Weinreb

"Our real workhorse sequence is VIBRANT. It's a fat-suppressed 3D scan, and we do it with a temporal resolution of less than two minutes. Although, with 3.0T technology and higher acceleration factors, we have the flexibility to select temporal resolution as low as 30 seconds while maintaining adequate image quality. However, based on published literature, we favor higher spatial resolution to achieve greater specificity. In our current protocol, we acquire a true isotropic voxel of 1mm, meaning there is no interpolation, with a temporal resolution of 90 seconds. For the dynamic scan, we generate datasets prior to and three times after uptake. We used to do this in the sagittal plane, followed by a delayed high resolution axial scan with VIBRANT. More recently, we have been performing the bilateral VIBRANT exams in the axial plane which allows us to achieve even higher spatial resolution and facilitates comparisons of the breasts."

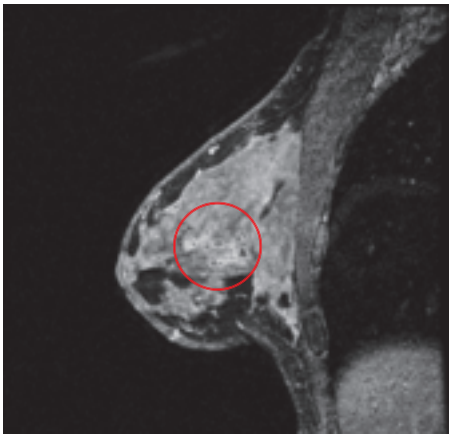
An automatic subtraction feature provides a valuable aid to diagnosis: It makes it easier to identify subtle or small areas of enhancement. "The first thing we look at is the first set of subtracted images," Dr. Weinreb said. "Then we go back to the other images just to validate what is enhancing, and also to look at other characteristics."

Cases in Point

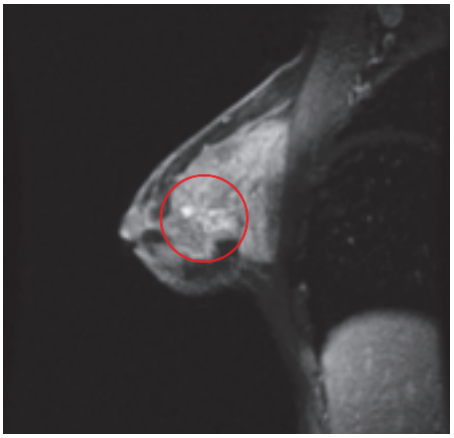
Dr. Weinreb cites three cases in which the GE Signa HDx 3.0T made a difference in diagnosis.

Case 1
Non-mass Enhancement: Comparison 3.0T/1.5T

A 54-year-old patient whose mammogram showed a focal asymmetric density was imaged at 1.5T. The images (right) showed a small, slightly irregular enhancing mass, and posterior to that an abnormal area of non-mass enhancement. "The findings were non-specific," Dr. Weinreb noted. A follow-up 3.0T scan using VIBRANT, six months later, shows clustered ring enhancement, a finding that is highly suggestive of DCIS.



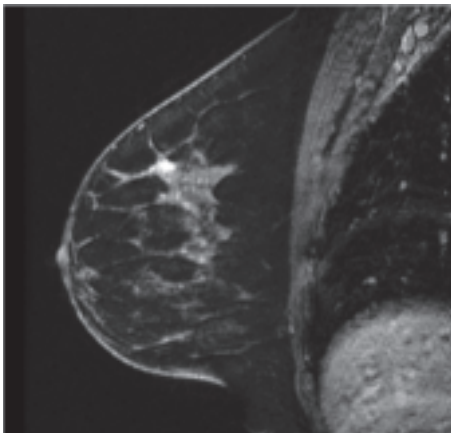
3.0T
2.0mm sl th
256 x 256 FOV 18
Voxel 2.0 x .7 x .7



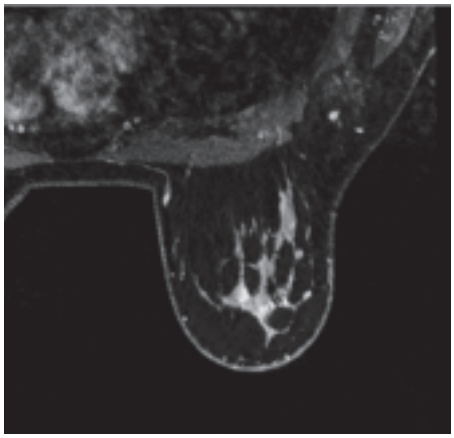
1.5T
3mm sl th
256 x 160 FOV 18
Voxel 3 x 1.1 x .7

Case 2
Benign Fibroadenoma: Comparison 3.0T/1.5T

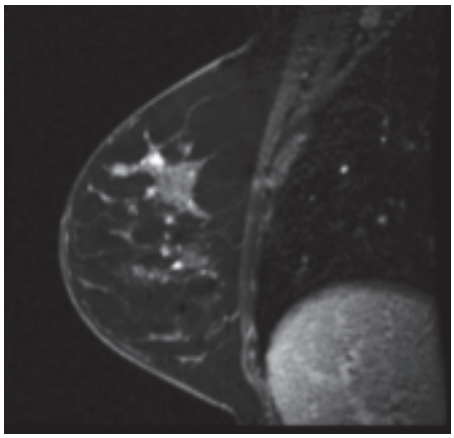
An MR study was performed for a 42-year-old patient who had a mastectomy on the left side for breast cancer and so was at high risk for the disease. Images from an exam at 1.5T show a bright area of enhancement that cannot be clearly evaluated. Dynamic images from a 3.0T scan using VIBRANT with higher spatial resolution show that the growth has smooth lobulated margins and an internal non-enhancing septation, a finding highly suggestive of benign fibroadenoma.



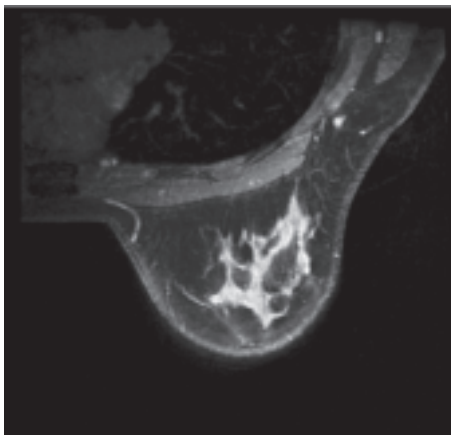
3.0T



1.0mm sl th



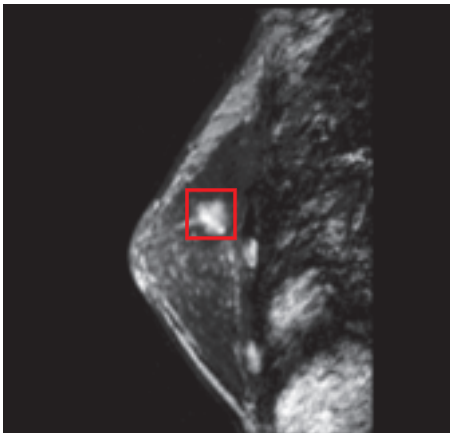
1.5T



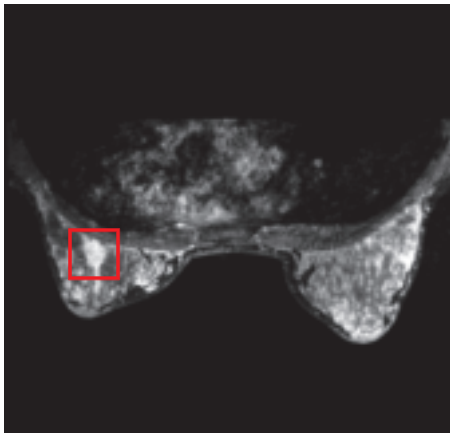
1.5mm sl th

Case 3
DCIS: 3.0T BREASE Exam Showing a Choline Peak

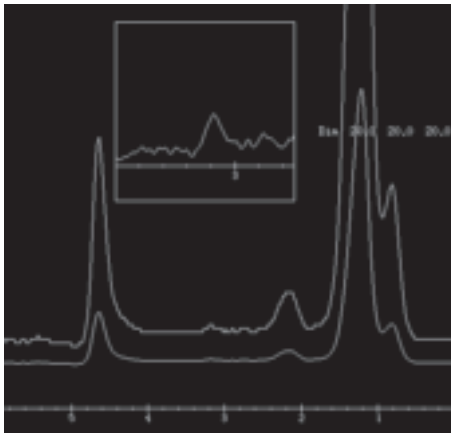
BREASE is a breast-specific spectroscopy application that is designed to enhance diagnostic confidence. It is a proton spectroscopy application optimized specifically for the breast that uses a signal detection technique to show elevated concentrations of choline. BREASE is a TE-averaged, PRESS spectroscopy acquisition compatible with a 4-, 7-, or 8-channel breast coil. ■



Sagittal VIBRANT



Axial VIBRANT



BREASE
Spectrum Showing a Choline Peak
Voxel 20mm x 20mm x 20mm
Scantime: Approx. 5 min.