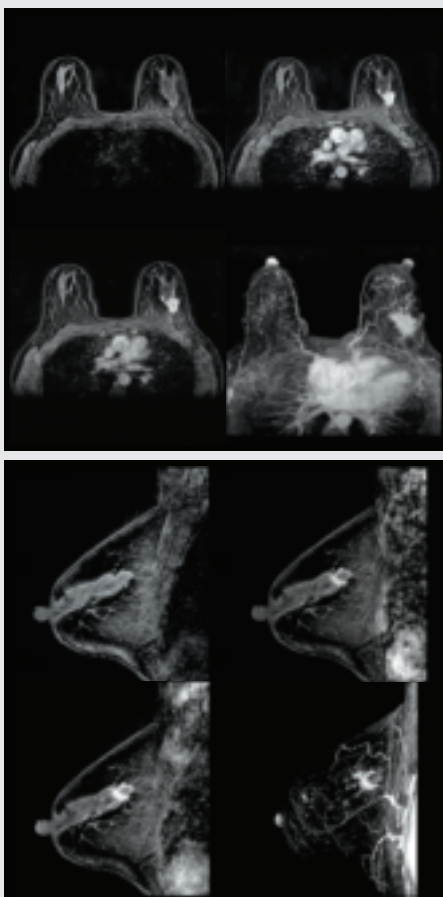


Clinical Case Study

Breast MRI Follow-up

Biopsy-Proven Infiltrating Ductal Carcinoma

Andrew T. Walker, MD
Beaches MRI
Palm Beach Gardens, Florida



Images 1 & 2: Dynamic contrast images from first and second follow-up exams: Upper left pre-contrast, upper right first time point post-contrast, lower left 4th time point post-contrast, and lower right MIP; demonstrating the reduced size of the malignant left breast lesion pre- and post-neoadjuvant therapy.

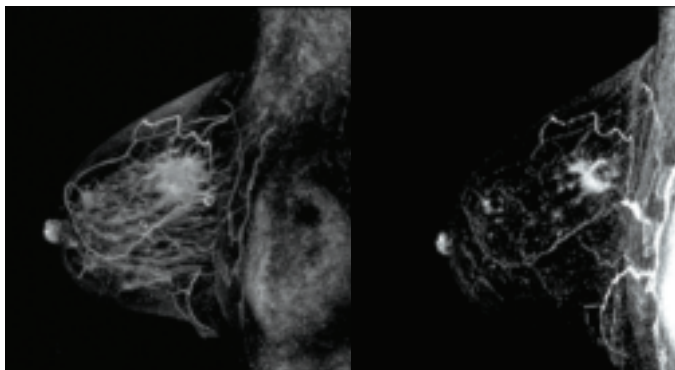
TECHNIQUE

Images were acquired on a 1.5T Toshiba Vantage ultra-short bore magnet. Using a dedicated 7-channel SPEEDER breast coil, multiple sequences optimized for breast imaging were obtained. Gadolinium was administered at an injection rate of 2cc/sec and the images were post-processed on a dedicated breast MRI workstation. This patient received two MRI breast examinations over a period of six months. The first exam was ordered to evaluate a left breast, biopsy-proven ductal cell carcinoma. A follow-up exam was ordered to evaluate the effects of the neoadjuvant treatment to the left breast.

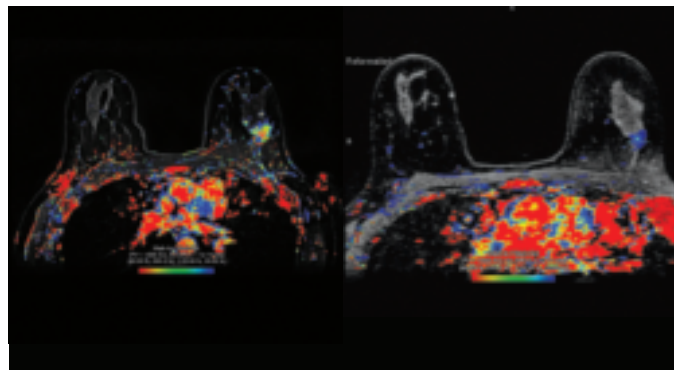
BACKGROUND

MRI has multiple benefits in helping to investigate breast concerns. An MRI exam allows breast images to be taken in any plane and from any orientation. One particular advantage of MRI is that it is highly sensitive to small abnormalities that can sometimes be missed with other

exams. For instance, a mammogram or ultrasound (sonogram) of the breast may reveal breast cancer in one area. However, an MRI of the breast may show that the cancer is in fact multi-focal; small tumors are present in several areas of the breast. The decision to have an MRI breast exam is made case-by-case by a team of breast care specialists. The decision may be based on the following criteria: abnormal mammogram or ultrasound, a positive breast biopsy, recent diagnosis for breast cancer, family history of breast cancer and dense breast tissue, follow up to chemotherapy treatment, implants, and past radiation treatment to the mediastinum. Determining the extent of breast cancer with MRI can help indicate treatment: breast conserving surgery (lumpectomy) or breast removal (mastectomy). This case study will highlight how a breast MRI evaluated the extent of a biopsy proven infiltrating ductal carcinoma.



Images 3 & 4: Sagittal MIP views of the malignant left breast lesion before and after neoadjuvant therapy.



Images 5 & 6: Comparison of CAD color overlay images demonstrating the malignant left breast lesion before and after neoadjuvant therapy.

CASE HISTORY AND FINDINGS

A 49 year-old woman presented with a palpable mass in her left breast. A mammogram was performed depicting a 3.0 x 3.0cm lesion. The patient's left breast was biopsied and the mass was determined to be a ductal carcinoma. The patient was then placed on chemotherapy and promptly referred for an MRI breast exam to evaluate the extent of disease. The breast MRI revealed a 2.9 x 3.3 x 3.4cm spiculated mass within the deep (zone C) 1–2 o'clock position of the left breast. The lesion demonstrated moderate abnormal enhancement (200–350%) with a predominate malignant kinetic enhancement pattern (washout), consistent with the patient's biopsy proven infiltrating ductal carcinoma. Scattered 0.5–1.0 cm satellite lesions were also observed extending anteriorly within the left upper outer and left lower outer quadrants, consistent with multifocal disease. The remainder of the left breast parenchyma was dense and heterogeneous. A few scattered sub-cm cysts were noted. No left breast skin thickening was present. The nipple

morphology was within normal limits without evidence of abnormal enhancement. No significant left axillary adenopathy was demonstrated by size criteria.

The right breast parenchyma was dense and heterogeneous. A few scattered sub-cm cysts were noted diffusely. Scattered 1–3mm foci of moderate abnormal enhancement (100–300%) with predominantly benign kinetic enhancement pattern (plateau and mildly progressive) were seen, most compatible with proliferative fibrocystic disease. No suspicious mass or focal abnormal enhancement was identified. No right breast skin thickening was demonstrated. The right nipple morphology was within normal limits without evidence of abnormal enhancement. No significant right axillary adenopathy was demonstrated by size criteria.

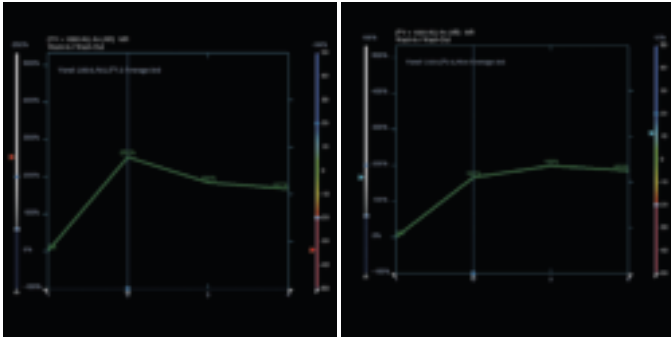
The overall impression on the left breast was a spiculated mass, which correlated with the patient's biopsy proven invasive ductal cancer. Several smaller scattered lesions from 0.5–1.0cm were detected that

extended anteriorly within the left upper and left lower outer quadrants, consistent with multi-focal breast disease.

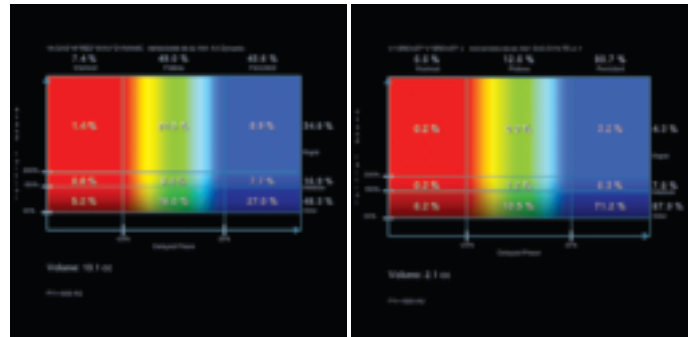
The right breast demonstrated diffusely scattered punctate foci of moderate abnormal enhancement with predominantly benign kinetic enhancement patterns, most compatible with proliferative fibrocystic disease. No other suspicious mass nor abnormal enhancement patterns were identified. The left breast MRI BI-RADS was scaled as a category 6 equating to a known cancer. Whereas the right breast MRI BI-RADS was categorically defined as a category 2 equating to a benign (noncancerous) finding.

DISCUSSION

Breast MRI has proven to be a highly useful tool in diagnosis and monitoring of breast cancer. Used with mammography and ultrasound, the sensitivity and specificity of detection approaches 100%. This case study demonstrated the benefits of two follow-up MRI breast examinations over a period of 6 months post biopsy. The MRI



Images 7 & 8: Uptake curve of contrast medium in the identified malignant left breast before and after neoadjuvant therapy.



Images 9 & 10: Histograms comparing contrast volume enhancement of the malignant left breast lesion before (graph on left) and after (graph on right) neoadjuvant therapy. Note the overall percentage of volume of pixels in the red zone (type-3 washout), green zone (type-2 plateau), and blue zone (type-1 persistent).

breast exam was exploited for its extremely accurate method of disease detection throughout the breast and surrounding anatomy. It was determined that the patient did suffer from multifocal disease within her left breast based on the contrast enhanced 3D Quick post processed data. Multifocal disease is based on the following criteria:

- Benign tumors are typically smooth in shape and do not enhance
- Malignant tumors are irregular in shape (spiculated) and have heterogenous enhancement
- Tumors commonly have a high uptake curve, with rapid down-sloping as was the case with this patient's detected primary mass

The MRI breast exam was able to demonstrate the benefit before and after neoadjuvant chemotherapy to assess the left breast tumor response. The breast MRI revealed the left breast tumor had decreased in size. Not only did the primary tumor

decrease but the smaller multifocal lesions decreased in size and number as compared to the prior MRI breast exam. Comparison from both MRI breast exams revealed the later exams' uptake curves showed a more benign type enhancement demonstrating the effectiveness of the neoadjuvant chemotherapy. Fortunately, the axillary lymphatic system was negative for lymph node adenopathy both on the earlier and later breast MRI exams. With the SPEEDER breast coil, evaluation of lymphadenopathy is easily visualized.

In conclusion this case study demonstrates the strengths of breast MRI related to its ability to diagnose chemotherapy tumor response, staging and recurrence in the clinical setting.

PROTOCOL DESCRIPTION

**Imaging Technique:
FFE3D2.7_quick**

- TR: 5.9
- TE: 2.7
- BW/Hertz: 488
- Segments: 2
- FA: 20
- AFI RO: Half fourier imaging in the Read Out matrix, kspace is not completely filled approximately 60% of kspace is sampled instead of 100%
- Fine: RPS
- Fat Sat(Fat Free): On
- Gain: NL2
- Speeder: 1.0x2.0
- Vivid: 0.20
- PE: HF
- NAQ: 1
- FOV: 20cm x 20cm
- Matriz: 192x256
- Pixel Resolution: 0.5 x 0.4 x 1.4mm
- Time: 7:48
- Coil: 7-channel SPEEDER

References:

MR Imaging of the Breast for the Detection, Diagnosis, and Staging of Breast Cancer. Susan G. Orel, MD and Mitchell D. Schnall, MD From the Department of Radiology, Hospital of the University of Pennsylvania, 3400 Spruce St, Philadelphia, PA 19104. Received June 12, 2000; revision requested July 17; revision received September 14; accepted October 2.

Multifocal and Multicentric Breast Cancer: Does Each Focus Matter? Nathan J. Coombs, John Boyages. From the New South Wales Breast Cancer Institute, University of Sydney, Westmead Hospital, Westmead, NSW 2145, Australia

Current Use of MRI in a Dedicated Breast Imaging Practice: Indications and Outcome Analysis. Philpotts L.E.; Andrejeva L.*; Fan J.; Hooley R.; Horvath L.; Tocino I.; Department of Diagnostic Radiology, Yale University School of Medicine, New Haven, CT.

TOSHIBA AMERICA MEDICAL SYSTEMS, INC.

2441 Michelle Drive, Tustin CA 92780 / 800.421.1968

©Toshiba Corporation 2007. All rights reserved.



Printed on recycled paper using soy inks