Breast Magnetic Resonance Imaging for Monitoring Response to Therapy

Haydee Ojeda-Fournier, MD[a,*], Jade de Guzman, MD[a], Nola Hylton, PhD[b]

KEYWORDS

• Breast cancer • Magnetic resonance imaging • Neoadjuvant chemotherapy • Response prediction • Pathologic complete response • Mammography • Ultrasound • Breast conservation

KEY POINTS

- Dynamic contrast-enhanced (DCE) breast magnetic resonance (MR) is the most sensitive imaging modality in routine clinical practice and the most highly correlated with disease.
- The information obtained from DCE-MR is of clinical usefulness in guiding oncologists in treatment assessment and in guiding surgeons in the selection of patients who are potential candidates for breast conservation.
- The type of response to neoadjuvant chemotherapy noted by DCE-MR may be a predictor of overall and disease-free survival.
- Although there may be false-negative appearances caused by the chemotherapy effect on neovascularity.

INTRODUCTION

Dynamic contrast-enhanced breast magnetic resonance (MR) imaging (DCE-MR) is now recognized as an important adjunct imaging modality in the evaluation of patients with new diagnosis of breast cancer. The American College of Radiology has created and revised the guidelines for the performance of DCE-MR.[1] Related to breast cancer imaging, the indications include evaluation of extent of disease for a known cancer, screening of high-risk patients, screening of the contralateral breast for patients with a new breast malignancy, and assessing response to neoadjuvant chemotherapy. The indications for neoadjuvant chemotherapy include decreasing the size of tumor to render the patient a candidate for breast conservation, predicting long-term disease-free survival, and primary treatment of inflammatory breast cancer. This article reviews locally advanced breast cancer and the role DCE-MR plays in its management, as well as emerging MR technology specific to assessment of response to neoadjuvant chemotherapy.

LOCALLY ADVANCED BREAST CANCER

Box 1 summarizes the characteristics of locally advanced breast cancer. Locally advanced breast cancer is stage III disease that includes large primary tumors or suspicious regional lymph nodes.[2] Primary tumors are considered advanced if they measure greater than 5 cm in greatest dimension, they extend to the chest wall or skin, or if the tumor invades the dermal lymphatics in the case of inflammatory breast cancer. Smaller sized primary tumors may also be considered advanced in relation to a small-sized breast.

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[a] University of California San Diego Moores Cancer Center, 3855 Health Science Drive, ML #0846, La Jolla, CA 92093, USA; [b] University of California, San Francisco, San Francisco, CA 94122, USA
* Corresponding author.
E-mail address: hojeda@ucsd.edu

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Box 1
Features of locally advanced breast cancer

Locally advanced breast cancer

Greater than 5 cm

Tumors of 3 to 5 cm in small breast

Tumor of any size associated with skin or chest wall involvement

Fixed or matted axillary lymph nodes

Ipsilateral infraclavicular or supraclavicular nodes

Absence of distant metastasis

Regional adenopathy is considered advanced if it is level I, II, or III (infraclavicular) axillary adenopathy, ipsilateral supraclavicular adenopathy, or ipsilateral internal mammary adenopathy with or without axillary adenopathy. Nipple retraction and skin changes can also be clinically seen in association with tumors in locally advanced breast cancer. DCE-MR imaging and clinical features of locally advanced breast cancer are shown in Fig. 1.

Distant metastases are not a feature of locally advanced breast cancer and thus locally advanced breast cancer is amenable to surgical treatment. A distinction is also made between locally advanced breast cancer and inflammatory breast cancer, which are two different diseases. Inflammatory breast cancer is discussed in this article because it is primarily treated with neoadjuvant therapy. In some cases, inflammatory breast cancer can be converted into an operable and curable disease after treatment with neoadjuvant chemotherapy.

Women who undergo routine mammographic screening represent less than 10% of patients with locally advanced breast cancer; however, in many underserved populations and globally, where routine mammographic screening is not available or underused, locally advanced breast cancer can be seen in up to 60% of diagnosed breast cancers.[3] On presentation, locally advanced breast cancers are generally not amenable to breast-conserving surgery. If the woman desires breast

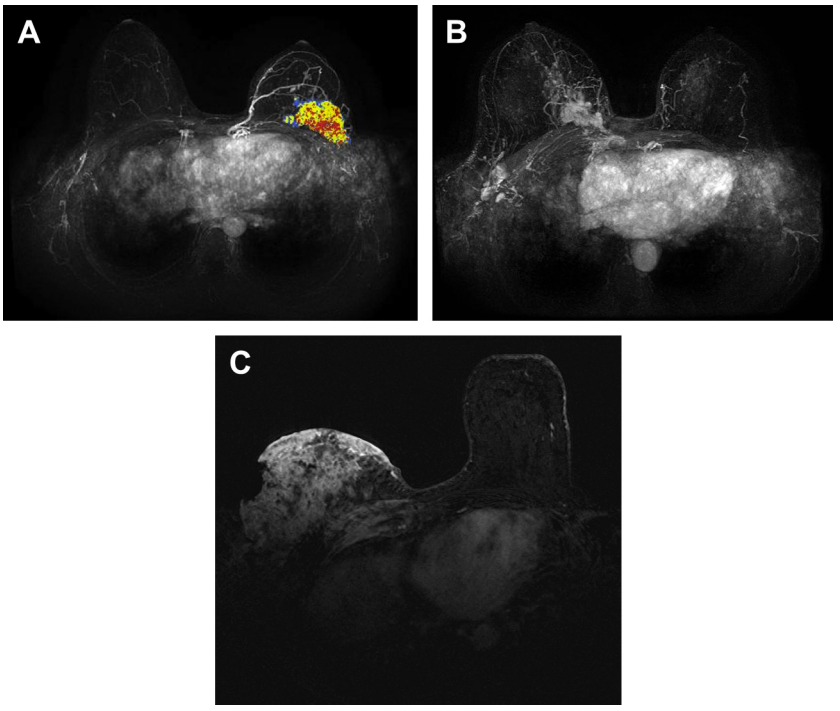

Fig. 1. MR imaging and clinical features of locally advanced breast cancer. (*A*) A 25-year-old patient presenting with triple-negative invasive ductal carcinoma nuclear grade 3 measuring 4.5 cm in left upper outer quadrant and small breast size. (*B*) A different patient with 3.9-cm right upper inner quadrant mixed invasive ductal and lobular carcinoma nuclear grade II/III and chest wall invasion. (*C*) A third patient with invasive breast cancer replacing the breast and invading the skin. Patient also has chest wall invasion as manifested by enhancement of the pectoralis and intercostal muscles.