Case Report
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MRI of Breast Lymphoma: A Report of Two Cases with Emphasis on Diffusion Weighted Imaging and Apparent Diffusion Coefficient Value

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Abstract

Breast lymphoma is a rare neoplasm that accounts for approximately 0.04-0.5% of breast malignancies. Most breast lymphomas are B-cell type non-Hodgkin lymphomas. The imaging features of breast lymphoma on mammography and ultrasound are non-specific. There have been several reports on magnetic resonance imaging characteristics of breast lymphoma but only few have described features on diffusion weighted imaging. Herein, we describe the magnetic resonance imaging findings, with emphasis on diffusion weighted imaging and the apparent diffusion coefficient sequences, of two cases of breast lymphoma and compare them with the magnetic resonance imaging features reported in the literature.

Keywords: Breast lymphoma, Magnetic resonance imaging, Kinetic curve, Diffusion weighted imaging (DWI), Apparent diffusion coefficient (ADC)

Introduction

Breast lymphoma (BL) is very rare and accounts for approximately 0.04-0.5% of all breast malignancies.[1] It can occur as a primary breast tumor or extranodal manifestation in systemic disease. Primary BL is defined as a disease that is limited to the breast or the breast and ipsilateral lymph nodes. Secondary BL, which is more common, usually presents with multiple breast lesions and known previous disease or with simultaneous lesions in the breast

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and one or more non-mammary organs.[2] Most BLs are B-cell type non-Hodgkin lymphomas.[3]

The imaging features of BL on mammography and ultrasound are non-specific. Most lesions have been described as high-density irregular or lobulated masses on mammography and solid non-circumscribed hypervascular masses on ultrasonography.[2,4,5]

Magnetic resonance imaging (MRI) features of BL have been reported in a few case series[1,4,6-9] and single case reports.[10,11] However, few included features on diffusion weighted imaging (DWI) or the apparent diffusion coefficient (ADC) value.[1,7,12] The morphological and enhancement patterns of BL on MRI are non-specific and variable, which limit its specificity. Studies have demonstrated the role of DWI sequences and ADC value in characterization of breast lesions.[13-15]

We report the findings of dynamic contrast enhanced MRI (DCE-MRI), DWI, and ADC value of BL in a 25-year-old immunosuppressed woman and a 25-year-old postpartum woman.

Case reports

Case 1

A 25-year-old woman presented with a 3-week history of rapidly enlarging bilateral breast masses, which began as a painless right breast lump. She had no underlying medical illness and denied any constitutional symptoms. Physical examination revealed large, hard, non-tender masses that occupied both breasts. The overlying skin was tight and erythematous. There was no nipple retraction or axillary lymphadenopathy. Ultrasound showed extensive ill-defined heterogeneous hypoechoic masses with no posterior features and increased vascularity that

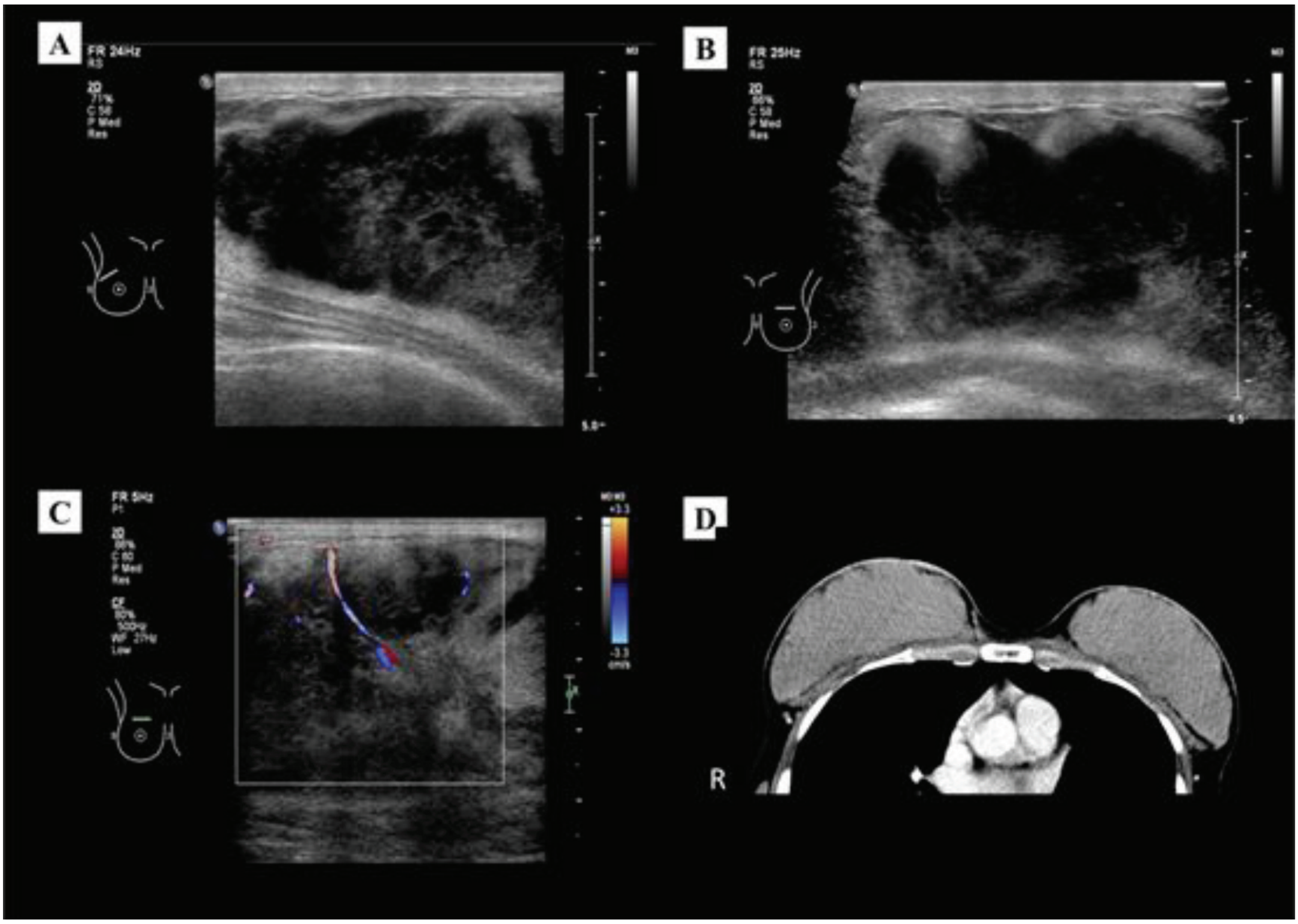

Figure 1. Ultrasound of both breasts (A & B) demonstrated ill-defined heterogeneous hypoechoic masses that occupied the entire breasts, but were predominantly located in the upper quadrants. Color Doppler examination (C) showed increased vascularity. Contrast-enhanced CT (D) demonstrated heterogeneously enhancing lobulated masses that occupied the entire breasts.

occupied the entire breasts, predominantly in the upper inner quadrants (Figure 1). There were no enlarged axillary lymph nodes.

Breast MRI was performed using a 3.0 T machine with a dedicated bipolar phased-array breast coil (GE Healthcare, Milwaukee, WI, USA). MRI (Figure 2) revealed heterogeneously enhancing lobulated masses with enhancing internal septation that occupied almost the entire breasts and measured approximately 5.0 (AP)×10.8 (W)×13.3 (H) cm on the right and 4.6 (AP)×9.4 (W)×12.1 (H) cm on the left. DWI (b=1000) demonstrated restricted diffusion with mean ADC values that ranged between 0.375×10-3-0.417×10-3 mm^2/s. Kinetic analysis demonstrated type III curve in multiple regions of interest. Areas of edema were seen in the lower quadrants of both breasts. There were no abnormal axillary nodes bilaterally.

Ultrasound guided core biopsy of both breasts were diagnostic for high grade non-Hodgkin B-cell lymphoma consistent with Burkitt's lymphoma. Laboratory tests demonstrate positive serology for human immunodeficiency virus with a CD4 count of 41 cell/uL.

CT abdomen and pelvis revealed a lobulated heterogenously enhancing solid mass with cystic component in the rectouterine pouch that measured 6.0 (AP)×8.8 (W)×6.0 (H) cm. The right ovary was not visualized. The left ovary was normal. No abdominal or pelvic lymphadenopathy was present.

CT guided biopsy of the ovarian mass was performed and histopathologic findings were

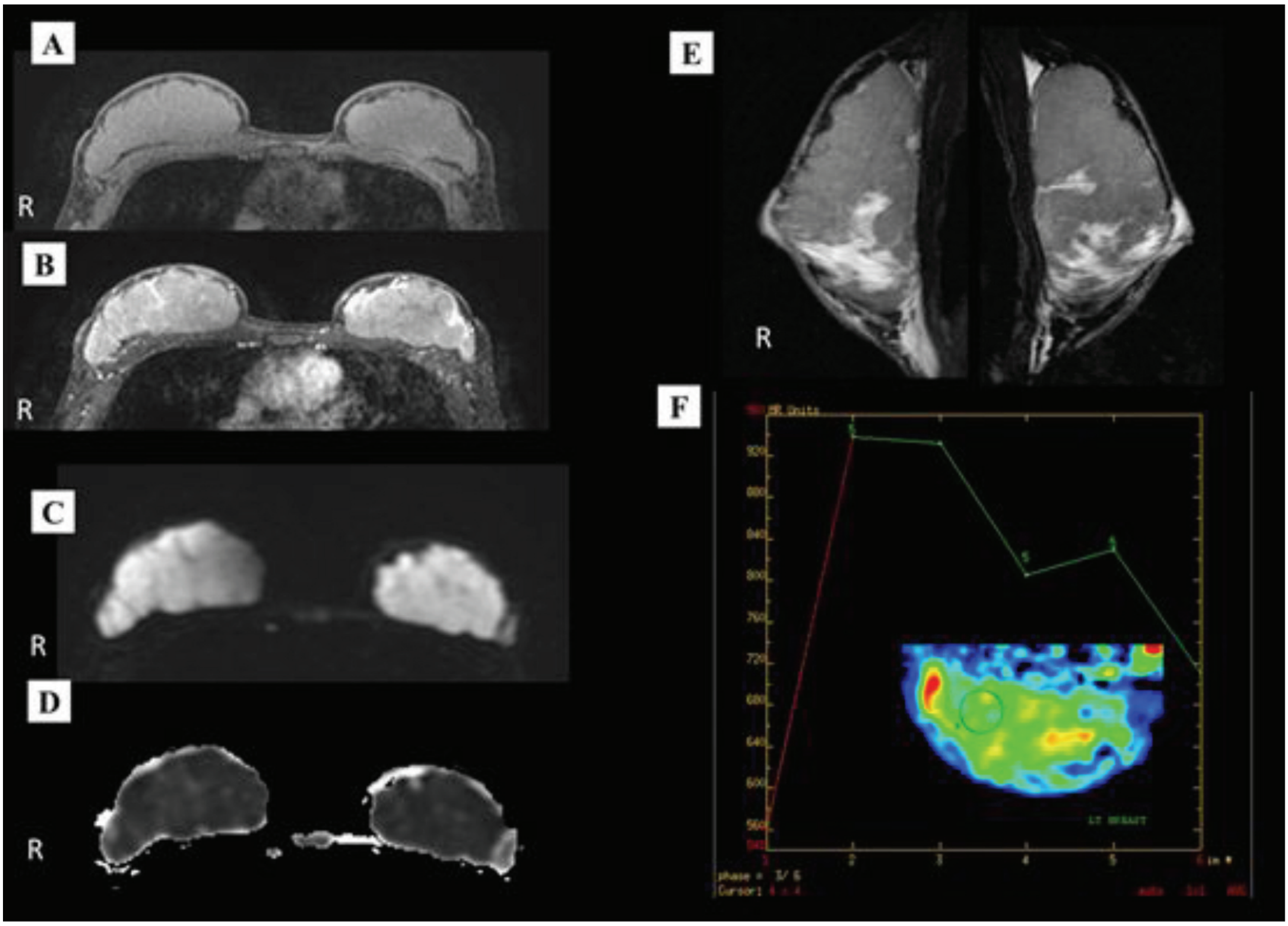

Figure 2. Precontrast axial T1W FAT-SAT image (A) demonstrated isointense lobulated masses that mostly occupied the entire breasts. Post-contrast axial T1W FAT-SAT image (B) revealed heterogeneous enhancement of the lobulated masses with enhancing internal septation. Diffusion weighted imaging (DWI) (C) and ADC (D) images demonstrated restricted diffusion. Precontrast sagittal T2W FAT-SAT image (E) showed the masses were predominantly in the upper quadrant with areas of hyperintensity in the lower quadrant suggestive of edema. Time-intensity curve of the mass at one of the regions of interest (ROI) (F) demonstrated rapid initial enhancement and washed out on the delayed phase (type III curve).

diagnostic for high grade non-Hodgkin B-cell lymphoma. The patient was treated with chemotherapy and concomitant anti-retroviral therapy.

Case 2

A 25-year-old woman presented with a painless left breast lump, 6 weeks post-delivery, which was progressively increasing in size. She had no underlying medical illness and denied any constitutional symptoms. Physical examination revealed a non-tender, irregular exophytic mass in the left upper inner quadrant that extended to the medial sternal edge. The overlying skin and nipple were normal. Ultrasound revealed a large circumscribed lobulated heterogeneous

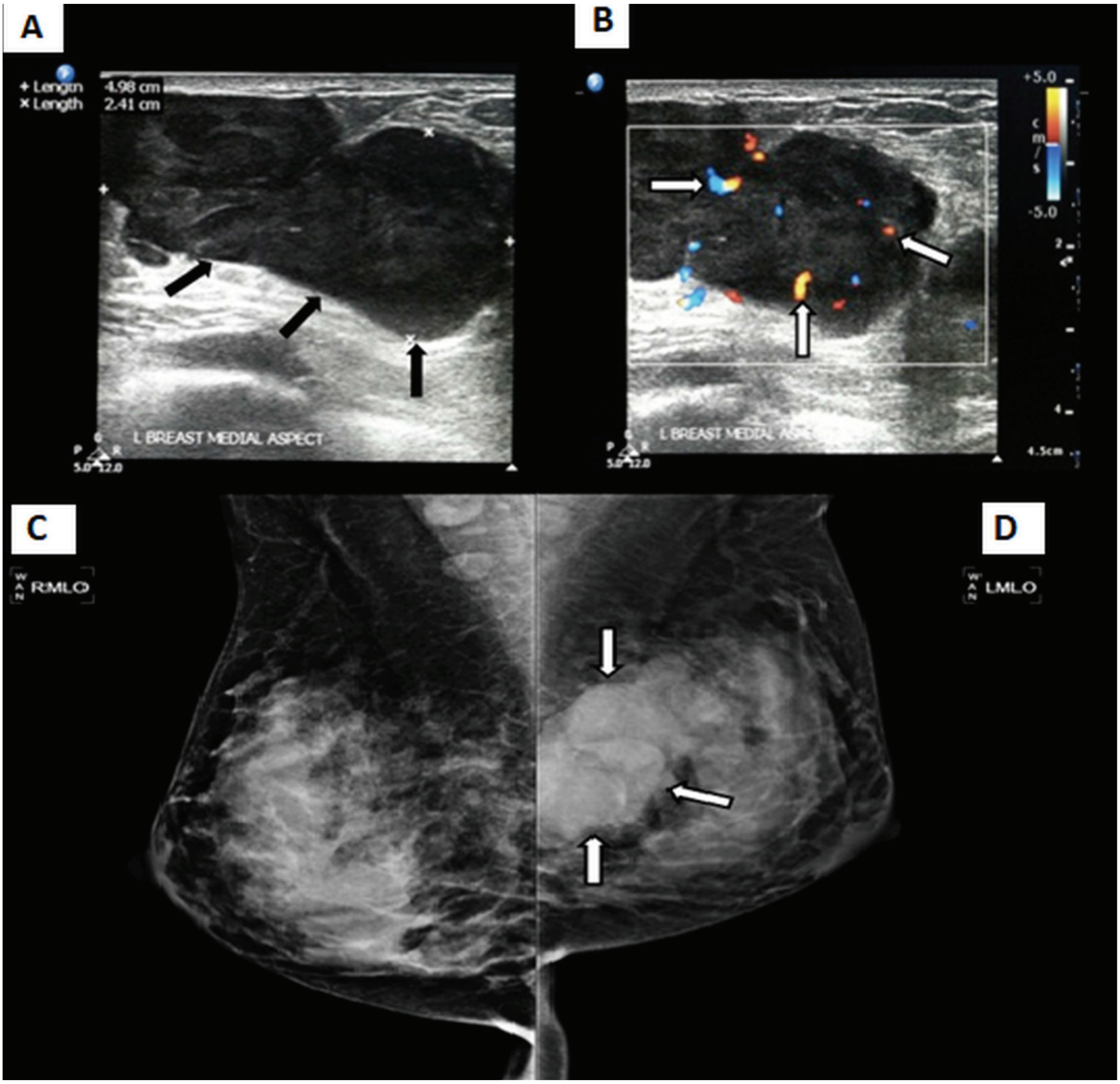

Figure 3. Ultrasound of the left breast in grey scale (A) and color Doppler (B) showed a large circumscribed heterogeneous, lobulated hypoechoic mass with areas of necrosis (black arrows) that occupied the medial half of the left breast. Color Doppler ultrasound demonstrated internal vascularity within the mass (white arrows). (C) and (D) Mediolateral oblique view (MLO) of both breasts that showed a large lobulated mass in the retromammary space of the left breast (white arrows). No suspicious cluster of microcalcifications or axillary lymphadenopathy were observed.

hypoechoic mass with internal vascularity and areas of necrosis that occupied the medial half of the left breast (Figure 3).

The mammogram demonstrated a large lobulated mass in the left retromammary space that measured approximately 7.0×4.0 cm (Figure 3). There were no associated microcalcifications, nipple retraction or skin thickening. The contralateral breast and both axillae were normal.

Breast MRI was performed using a 1.5T machine with a dedicated bipolar phased-array breast coil (Philips Health). MRI (Figure 4) revealed three well-defined heterogeneously enhancing lobulated masses located adjacent to each other in the posteromedial aspect of the left breast that measured 4.3×2.3×4.4 cm, 2.1×2.7×2.2 cm, and 3.1×3.9×4.6 cm. The lateral most mass was indented on the underlying pectoralis muscle and the medial most mass extended to the skin. Kinetic analysis demonstrated a type II curve. There were no abnormal axillary nodes bilaterally.

Ultrasound guided core biopsy was diagnostic for diffuse large B-cell lymphoma. Laboratory tests, CT of chest and abdomen, and bone marrow biopsy showed no involvement of any other sites. The patient was treated with chemotherapy.

Discussion

The morphology and enhancement of BL in DCE-MRI that has been reported in the literature are variable, hence limiting its specificity.[2,4,6,8,9] Reported series of BL on DCE-MRI demonstrated that BL masses usually have homogenous enhancement;[1,7,4,9,12] however, heterogeneously

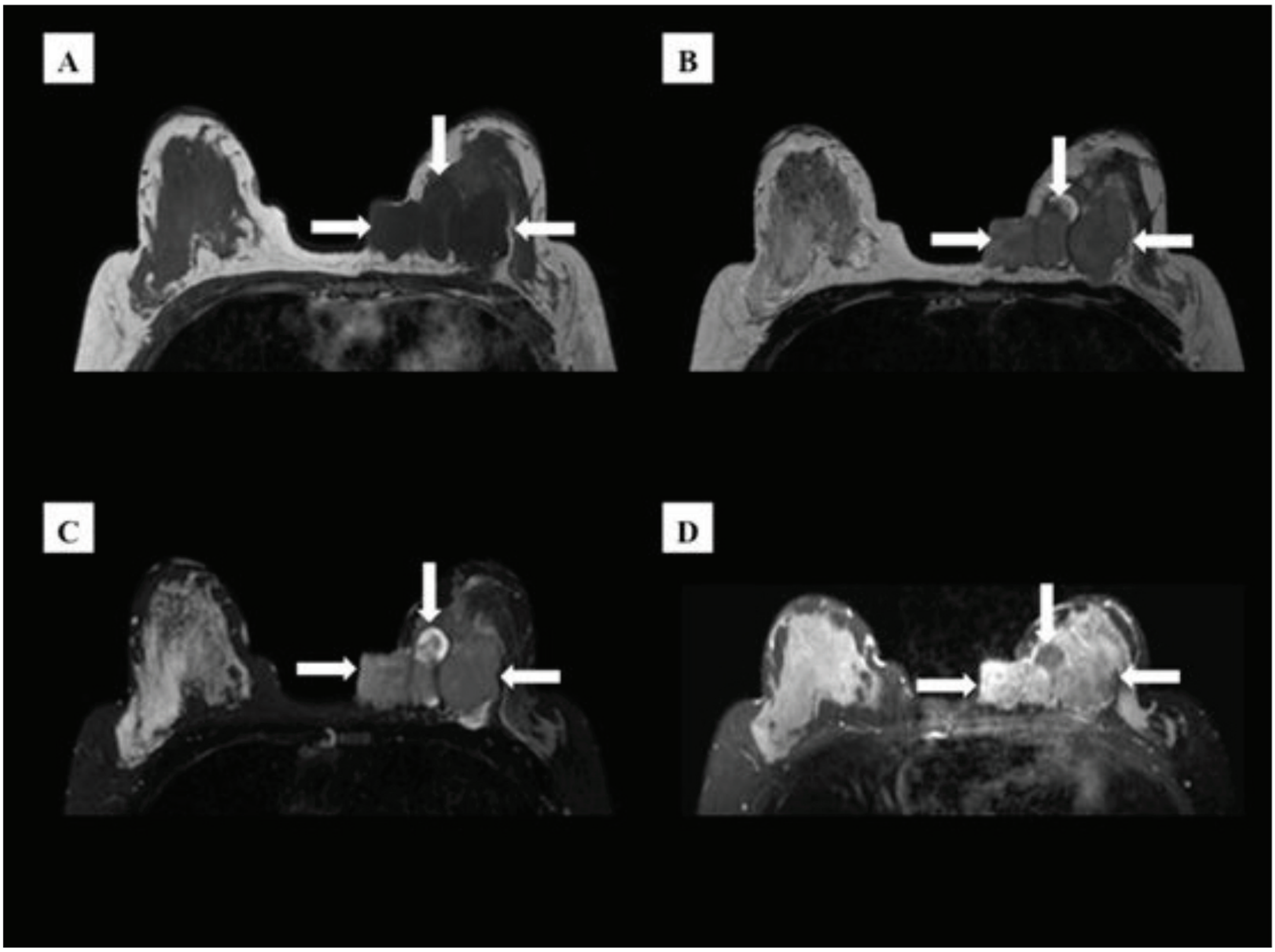

Figure 4. Axial images of both breasts by magnetic resonance imaging (MRI) in T1W (A), T2W (B), SPAIR (C) and post-gadolinium administration (D). There were 3 well-defined lobulated masses (white arrows) in the posteromedial aspect of the left breast. These masses demonstrated hypointense signals on T1W sequence and heterogeneous signals on T2W/SPAIR sequences compared to the breast parenchyma and heterogeneous enhancement post-contrast.

enhancing masses have been described in a large series of 20 patients with 82 lesions.[6] Although type II kinetic curve occurs in more BL cases, all of the described curves have been shown to occur in the reported series.[1,4,6,7,9,12] The masses in the both patients were heterogeneously enhancing on the dynamic images. Kinetic analyses demonstrated types II and III curves in the patients, respectively.

Recent studies have demonstrated the role of DWI and ADC in differentiation of malignant and benign lesions.[14,16-19] DWI is a functional imaging that characterizes lesions by demonstrating the physiological properties of water movement in various tissues. Apparent diffusion coefficient is the quantitative measurement of the diffusivity of water and provides information related to lesion cellularity and cell membrane integrity. Malignant lesions usually demonstrate high signals on DWI with low ADC values as the increased cellular density and reduced extracellular space restrict water diffusion.

Several studies demonstrated the role of DWI sequences and ADC value in the characterization of breast lesions.[13-15] Fewer have reported the features of DWI and the ADC values of BL.[1,7,12] There is a considerable variability in the mean ADC values of the reported benign and malignant breast lesions; however, the suggested absolute ADC threshold values range from 1.1 to $1.6\times10{-}3$ mm^2/s.[13]

High intensity signals on DWI and consistently low ADC values that range from $0.37\text{-}0.41\times10\text{-}3$ mm^2/s, which we observed in all of the masses in our cases reflected the high cellularity of the lesions and was consistent with malignant lesions. This very low ADC value might possibly indicate a diagnosis of lymphoma.

In summary, lymphoma of the breast is often a challenge to diagnose because of disease rarity and non-specific imaging findings. There is a limited specificity with DCE-MR in the diagnosis of BL. Additional DWI sequence and evaluation of the ADC values is useful for further characterization of breast lesions. In the current cases, the addition of DWI and ADC values in combination with DCE-MRI in the assessment of the BL increased the specificity for breast lesion classification by MRI.

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Conflict of Interest

None declared.

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