CASE REPORT

Dynamic MR Findings of Ductal Carcinoma in Situ within a Fibroadenoma

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(Received July 7, 2010; Accepted December 8, 2010)

We report magnetic resonance (MR) imaging findings of ductal carcinoma in situ (DCIS) within a fibroadenoma in a 42-year-old woman. Dynamic MR imaging revealed the mass to have 2 components with different kinetics. A nodular area within the mass showed faster initial enhancement followed by earlier washout and was histologically proven to be DCIS. Dynamic MR imaging reflected differences in vascularity between the fibroadenoma and DCIS, and parameter color maps generated from the dynamic data clearly demonstrated the extent of the DCIS.

Keywords: DCIS, dynamic MRI, fibroadenoma, parameter color map

Introduction

Fibroadenoma is a common benign breast tumor in which carcinoma rarely arises. We found only one report of magnetic resonance (MR) imaging findings of carcinoma within a fibroadenoma.1 The shape of the time intensity curve is an important criterion in differentiating benign from malignant enhancing lesions in dynamic MR imaging of the breast.2 Parameter color maps generated from dynamic data through pixel-by-pixel analysis detail differences in lesion vascularity. We report a case of ductal carcinoma in situ (DCIS) within a fibroadenoma and focus on MR imaging findings, especially as revealed in parameter color maps.

Case Report

A 42-year-old woman was referred to our hospital for a mass in her right breast detected at a medical check-up. On physical examination, an elastic, hard, and irregularly shaped mass measuring 1.5 cm in diameter was palpable in her right breast. Mammograms showed a microlobulated mass of high density that contained pleomorphic clustered calcifications (Fig. 1). This pattern of cal-

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Fig. 1. Mediolateral oblique view mammogram of the right breast shows a mass of high density with pleomorphic clustered calcifications.
cification suggested malignancy. Breast ultrasonography revealed a hypoechoic solid mass with calcifications. Diagnosis of DCIS followed ultrasonography-guided biopsy. MR imaging was ordered to evaluate the extent of the lesion.

In a prone position, the patient underwent MR imaging in a 1.5-tesla system (Avanto, Siemens Medical System, Erlangen, Germany) with a circular polarization breast array coil. Dynamic images were acquired bilaterally in the axial plane with a 3-dimensional fast low-angle shot (3D-flash) sequence (repetition time/echo time, 9.3 ms/4.7 ms; flip angle, 25°; field of view, 320 mm; slice thickness, 2.7 mm; slices per slab, 48; matrix, 512 × 394; integrated parallel acquisition techniques [iPAT] mode, generalized autocalibrating partially parallel acquisitions [GRAPPA]; iPAT factor, 2; 86 s per scan) before and 6 acquisitions immediately after intravenous administration of contrast material (gadopentetate dimeglumine, 0.1 mmol/kg). Contrast material was administered manually and flushed with standardized 20 mL of saline. Dynamic data were post-processed by the Siemens workstation program (Syngo 2004A), and 3 parameter maps (wash-in, wash-out, and time to peak) were generated through pixel-by-pixel analysis. Wash-in (WI) parameter images display signal changes from the pre-enhanced scan to the second phase. Wash-out (WO) parameter images display signal changes from the third phase to the sixth phase. Time-to-peak (TTP) parameter images display the time in seconds until the maximum signal. Rapidly enhancing masses appear red on WI images. Masses with washout kinetics appear blue on WO images. Masses reaching the maximum early appear red on TTP images.

Fig. 2. (A) Fat-suppressed T2-weighted image shows a mass of high intensity with a nodule of low intensity. (B) Wash-in parameter image generated from dynamic data as a signal change from a pre-enhanced scan to second phase shows a yellow mass with red nodular area. The red color indicates faster initial enhancement of the nodular area. (C) Wash-out parameter image generated from dynamic data as the signal change from the third phase to the sixth phase shows a blue-colored mass with an even bluer nodular area. The blue color indicates early wash-out of the nodular area. (D) Time-to-peak parameter image generated from dynamic data as the time in seconds until the signal maximum shows a yellow mass with a red nodular area. The red color indicates faster time to peak of the nodular area.
On fat-suppressed T2-weighted images (T2WI), the mass demonstrated high intensity with a nodule of low intensity (Fig. 2A). The mass was yellow on WI and TTP images and blue on WO images (Fig. 2B–D), so we interpreted the mass as having faster initial enhancement followed by earlier washout. These findings indicated 2 different components within the mass.

The patient underwent breast-conserving surgery and biopsy of the sentinel lymph nodes. Histopathological examinations revealed the tumor’s primary lesion as a fibroadenoma and the mass it contained as a high grade DCIS with comedonecrosis and calcifications (Fig. 3). Stromal cells were observed in larger areas in the fibroadenoma than in the DCIS. The extent of DCIS agreed well with the nodular area that showed a rapid initial rise and early washout on dynamic MR imaging. The excised sentinel lymph nodes showed no evidence of metastasis.

**Discussion**

Fibroadenoma of the breast is a common benign tumor that rarely contains a carcinoma. The prevalence of such carcinoma has been reported as 0.02% in a screening population. Carcinoma in situ has been reported as the predominant type of malignancy within fibroadenomas, with ductal and lobular types occurring with equal frequency. Baker’s group reported carcinomas originating within fibroadenomas as round, oval, or lobulated mass on mammograms. Seven of their 24 cases had calcification, four of which were fibroadenoma-type and three had microcalcifications with suspicious findings; only one of the 3 cases had microcalcifications associated with the carcinoma. Borecky and Rickard reported 3 cases of carcinoma within fibroadenoma that were diagnosed preoperatively by core biopsy; mammographic findings that suggested this diagnosis were margin irregularity and associated new suspicious pleomorphic and linear calcifications.

Typically, a fibroadenoma appears on MR imaging as a focal round or oval-shaped mass with smooth margins, and myxoid fibroadenoma tends to exhibit high signal intensity on T2WI. Fibroadenoma can exhibit variable enhancement; however, enhancement does not peak in the early post-contrast phase but usually persists until the late phase, and a washout curve is only occasionally seen. The typical DCIS appears as non-mass-like enhancement with segmental or linear (ductal) distribution. About 70% of DCIS lesions exhibit rapid early enhancement; delayed phase enhancement varies.

In our case, MR imaging findings correlated well with pathological results, and parameter images clearly demonstrated the extent of the DCIS. The major part of the mass consistent with fibroadenoma on MR imaging (high signal on T2WI and peak enhancement that was not especially early) was histologically proven to be fibroadenoma. The area of DCIS showed rapid initial enhancement and washout kinetics on dynamic MR imaging, which was consistent with malignancy.

We found only one report of dynamic MR findings of carcinoma within a fibroadenoma, which described a mass showing a pattern of early peak enhancement in the central area and delayed rim enhancement in the periphery. Histologically, DCIS was found in the center of the fibroadenoma, and MR findings correlated well with histopatho-
logic results. The dynamic MR findings of their case are quite similar to ours.

In conclusion, dynamic MR imaging findings reflect differences in vascularity between a fibroadenoma and DCIS, and parameter color maps can demonstrate the extent of a DCIS within a fibroadenoma.

References