Learning objectives

1. Recognize MRI findings of DCIS.
2. Correlate MRI findings of DCIS with mammographic findings.
3. Recognize limitations of both mammographic and MRI findings of DCIS.

Background

Ductal carcinoma in situ (DCIS) of the breast is a noninvasive malignancy confined to the breast ducts and lobules without histologic evidence of extension through the basement membrane. The term DCIS encompasses a heterogeneous group of neoplastic lesions that vary in histologic appearance and biologic potential. The detection of DCIS over time has increased considerably with the advent of mammography. DCIS accounts for 20% of all breast cancer and approximately 30 to 50% of all mammographically detected cancer (1). It is estimated that approximately 30 to 50% of all DCIS will progress to invasive disease (2).

DCIS typically presents on mammography as microcalcifications within necrotic tumors in the ducts. Less common presentations of DCIS include mass, asymmetry or architectural distortion. Although the detection of DCIS has increased considerably with mammography, there are some limitations with mammography when it comes to evaluation of DCIS. These limitations include difficulty with evaluation of dense breasts and assessment of uncalcified DCIS (3,4). The sensitivity of mammography for detecting DCIS and extent of disease therefore varies widely ranging anywhere from 27 to 80% (2, 5-7).

Magnetic resonance imaging (MRI) has high sensitivity in imaging invasive cancers and has the advantage of detecting non calcified DCIS that may be occult on mammography. Small calcified DCIS detected on mammography however, may be occult on MRI (3). Also due to the heterogeneous appearance of DCIS on MRI, the sensitivity of MRI for the detection of DCIS is highly variable ranging anywhere from 40 to 92% (3). Although currently MRI is not routinely indicated in the work up for newly diagnosed DCIS, dynamic contrast enhanced MRI may be helpful in conjunction with mammography for determining the extent of calcified and noncalcified DCIS thereby helping with appropriate treatment planning.
Imaging findings OR Procedure details

Although many argue that not all DCIS progresses to invasive carcinoma, our inability to determine which lesions will progress to invasive cancer results in treating DCIS as a potentially lethal entity. DCIS is not a single pathologic entity but rather represents a spectrum of diverse histopathologic carcinomas in situ with numerous classifications schemes, the most common involving evaluation of nuclear grade and presence or absence of necrosis. Understanding mammographic and MRI findings of DCIS and their limitations to detect DCIS can potentially increase our sensitivity for increased detection and earlier treatment before possible invasive carcinoma occurs.

The most common presentation of DCIS on mammography is microcalcifications, however DCIS can also present as mass lesions, architectural distortion, and may also be occult on mammography. Low grade DCIS is more common to be non calcified than higher grades on mammogaphy. MRI has been shown to be more sensitive than mammography to detect DCIS. MRI is particularly useful to demonstrate extent of disease as DCIS as it is frequently underestimated on mammography. The most common enhancement pattern for DCIS is non mass enhancement in segmental or ductal distributions with internal clumped enhancement. DCIS most commonly demonstrates rapid kinetics. The kinetics of pure DCIS lesions have not been shown to correspond with pathologic grade, however there does appear to be a relationship between the kinetics of DCIS lesions and mammographic findings. Overall, image interpretation should be based on morphologic characteristics instead of enhancement kinetics given that only half of pure DCIS lesions will show kinetics consitent with malignancy.

We present 5 cases of pure DCIS from our institution to illustrate the varying presentations of DCIS on mammogram and MRI with occult disease noted on both modalities.

Case 1

51 year-old female with cluster of microcalcifications in the right outercentral breast on routine screening mammogram. Biopsy revealed stage 1 low-grade ductal carcinoma. An MRI performed for treatment planning revealed non-masslike enhancement in the right breast with mixed kinetics and areas of washout. Final pathology revealed low-grade invasive ductal carcinoma rising in fairly extensive DCIS. Fig. 1 on page 20 Fig. 2 on page 24 Fig. 3 on page 22 Fig. 4 on page 19 Fig. 5 on page 18 Fig. 6 on page 17
Fig. 1: Screening CC view of the right breast demonstrates group of calcifications in the outer breast.

References: Department of Radiology, Lahey Clinic - Burlington/US

Fig. 4: Axial MRI angiomap demonstrates extensive segmental non mass enhancement in the right breast with mixed kinetics. The MRI demonstrates extent of disease being significantly larger than perceived on mammogram.

References: Department of Radiology, Lahey Clinic - Burlington/US

Teaching point: Extensive DCIS presenting as small focus of calcifications with extent better depicted on MRI which can change surgical planning and avoid positive margins.

Case 2

50 year-old female with prior history of DCIS status post lumpectomy and radiation, patient chose not to take chemoprevention therapy. Family history of two aunts with breast cancer. Routine follow up MRI 3 years following above mentioned treatment showed a suspicious focal linear scar within the surgical bed with persistent enhancement. Of note, an interval mammogram showed no suspicious findings. Biopsy revealed multifocal high grade DCIS, Grade 3/3, solid and micropapillary patterns with comedonecrosis. Fig. 7 on page 26 Fig. 8 on page 28 Fig. 9 on page 30
**Fig. 7:** Screening LMLO mammogram demonstrates post lumpectomy changes. Subsequent MRI done for follow up of a previously noted abnormality demonstrated an ill defined area of non mass like enhancement which was subsequently biopsy high grade DCIS. This demonstrates how DCIS can be occult on mammogram.  
*References:* Department of Radiology, Lahey Clinic - Burlington/US

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**Fig. 9:** MRI sagittal angiomap demonstrates non mass like enhancement with persistent delayed kinetics. Biopsy demonstrated high grade DCIS. This area was occult on mammogram.  
*References:* Department of Radiology, Lahey Clinic - Burlington/US
Teaching point: DCIS can be mammographically occult if calcifications are not present, even high grade DCIS as in this case.

Case 3

73 year-old woman with new area of pleomorphic calcifications in the right breast on routine screening mammogram. Biopsy revealed microinvasive ductal carcinoma grade 2/3 arising in a background of high grade ductal carcinoma in situ. Subsequent MRI revealed large area of ductal nonmasslike enhancement with washout corresponding with known malignancy. Fig. 16 on page 37 Fig. 19 on page 32
Fig. 17: Screening RMLO of the right breast demonstrates a group of heterogenous calcifications in the posterior upper right breast. Biopsy positive for high grade DCIS.

References: Department of Radiology, Lahey Clinic - Burlington/US

Fig. 19: MRI MIPS demonstrates extent of disease after biopsy. Large area of ductal non mass like enhancement noted.

References: Department of Radiology, Lahey Clinic - Burlington/US

Teaching point: Extent of disease is far better depicted on MRI. Kinetics do not correspond with histopathologic grade.

Case 4

42 year-old woman with family history of breast cancer. Screening mammogram showed asymmetry with calcifications in the right breast. MRI revealed minimal duct ectasia and fibrocystic changes without suspicious enhancement in the corresponding area within the right breast. Biopsy was recommended after a six month followup mammogram showed persistent microcalcifications within the right breast. Due to inadequate breast compression a stereotactic biopsy could not be performed. A needle localized lumpectomy was performed with pathology showing small focus of DCIS low to intermediate grade.
Fig. 15: Screening mammogram demonstrates asymmetry in the right upper breast. Further studies were recommended. BSGI was recommended, but the patient did not follow up. MRI was subsequently performed which was negative. 6 months later a diagnostic mammogram was performed demonstrating faint calcifications in the upper right breast. Stereotactic biopsy was unsuccessful, and exisional biopsy was recommended. Pathology positive for DCIS.

References: Department of Radiology, Lahey Clinic - Burlington/US
Fig. 14: Spot mammogram demonstrates cluster of heterogenous calcifications at approximately 12:00, excisional biopsy yielded DCIS.

**References:** Department of Radiology, Lahey Clinic - Burlington/US

Fig. 16: Angiomap axial MRI demonstrates no evidence of abnormal enhancement. This demonstrates that not all DCIS can be detected by MRI.

**References:** Department of Radiology, Lahey Clinic - Burlington/US

**Teaching point:** MRI does not always detect DCIS lesions. DCIS maybe occult on MRI.

**Case 5**

62 year-old female with palpable abnormality in the upper outer quadrant of the left breast and negative mammogram and ultrasound studies. MRI revealed 12x8x8mm area of nonmass-like heterogenous enhancement with mixed kinetics including rapid initial and delayed washout corresponding with the palpable abnormality. Biopsy confirmed ductal carcinoma in situ without invasive carcinoma. Fig. 11 on page 39
**Fig. 10:** Screening LMLO mammogram demonstrates dense breast tissue, no abnormality noted.

*References:* Department of Radiology, Lahey Clinic - Burlington/US

**Fig. 12:** Sagittal T1 post gadolinium image of the left breast demonstrates focal heterogeneous non mass like enhancement, MRI guided biopsy positive for grade II DCIS.

*References:* Department of Radiology, Lahey Clinic - Burlington/US
Fig. 13: Contrast enhanced MRI done for palpable abnormality in light of dense breasts with normal mammogram demonstrates focal area of non mass enhancement with mixed kinetics. Subsequent biopsy positive for grade II DCIS.

**References:** Department of Radiology, Lahey Clinic - Burlington/US

**Teaching point:** DCIS presenting as palpable mass occult on mammogram and ultrasound studies.

Images for this section:
Fig. 6: Axial MRI MIPS demonstrate extent of DCIS in the right breast.
Fig. 5: Sagital MRI angiomap of the right breast again demonstrates the non mass like segmental enhancement with mixed kinetics.
Fig. 4: Axial MRI angiomap demonstrates extensive segmental non mass enhancement in the right breast with mixed kinetics. The MRI demonstrates extent of disease being significantly larger than perceived on mammogram.
Fig. 1: Screening CC view of the right breast demonstrates group of calcifications in the outer breast.
Fig. 3: Spot magnification views of the right breast demonstrate a pleomorphic group of calcifications, biopsy was recommended. Biopsy positive for low grade DCIS.
**Fig. 2:** RMLO view of the right breast demonstrates a group of calcifications in the posterior one third of the central right breast.
Fig. 7: Screening LMLO mammogram demonstrates post lumpectomy changes. Subsequent MRI done for follow up of a previously noted abnormality demonstrated an ill defined area of non mass like enhancement which was subsequently biopsy high grade DCIS. This demonstrates how DCIS can be occult on mammogram.
**Fig. 8:** Sagital T1 FAME post gadolinium image demonstrates non mass like enhancement in the lower left breast, biopsy revealed high grade DCIS.

**Fig. 9:** MRI sagittal angiomap demonstrates non mass like enhancement with persistent delayed kinetics. Biopsy demonstrated high grade DCIS. This area was occult on mammogram.
Fig. 17: Screening RMLO of the right breast demonstrates a group of heterogenous calcifications in the posterior upper right breast. Biopsy positive for high grade DCIS.

Fig. 19: MRI MIPS demonstrates extent of disease after biopsy. Large area of ductal non mass like enhancement noted.
Fig. 18: Angiomap sagittal image of the right breast demonstrates extent of high grade DCIS.
Fig. 15: Screening mammogram demonstrates asymmetry in the right upper breast. Further studies were recommended. BSGI was recommended, but the patient did not follow up. MRI was subsequently performed which was negative. 6 months later a diagnostic mammogram was performed demonstrating faint calcifications in the upper right breast. Stereotactic biopsy was unsuccessful, and excisional biopsy was recommended. Pathology positive for DCIS.
**Fig. 14:** Spot mammogram demonstrates cluster of heterogeneous calcifications at approximately 12:00, excisional biopsy yielded DCIS.

**Fig. 16:** Angiomap axial MRI demonstrates no evidence of abnormal enhancement. This demonstrates that not all DCIS can be detected by MRI.
Fig. 10: Screening LMLO mammogram demonstrates dense breast tissue, no abnormality noted.
Fig. 11: Screening CC mammogram of the left breast demonstrates dense breast tissue, no abnormality noted.

Fig. 13: Contrast enhanced MRI done for palpable abnormality in light of dense breasts with normal mammogram demonstrates focal area of non mass enhancement with mixed kinetics. Subsequent biopsy positive for grade II DCIS.
Fig. 12: Sagittal T1 post gadolinium image of the left breast demonstrates focal heterogenous non mass like enhancement, MRI guided biopsy positive for grade II DCIS.
Conclusion

DCIS is truly a spectrum of carcinomas with varying presentations. It is important to realize the limitations of both mammography and MRI to detect DCIS as lesions that can be occult on both modalities. Correlating MRI findings with mammography increases our awareness of the limitations of mammography particularly in the setting of non calcified DCIS. Understanding the common presentations and limitations of both modalities will ensure improved diagnosis presurgical planning with utilization of modalities such as MRI to improve detection and define true extent of disease.

References


Personal Information