Original Study

Magnetic Resonance Imaging-Guided Core Needle Breast Biopsies Resulting in High-Risk Histopathologic Findings: Upstage Frequency and Lesion Characteristics

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Abstract

Analysis of magnetic resonance imaging-guided breast biopsies yielding high-risk histopathologic features at a single institution found an overall upstage rate to malignancy of 14% at surgical excision. All upstaged lesions were associated with atypical ductal hyperplasia. Flat epithelial atypia and atypical lobular hyperplasia alone or with lobular carcinoma in situ were not associated with an upstage to malignancy.

Introduction: The purpose of the present study was to determine the malignancy upstage rates and imaging features of high-risk histopathologic findings resulting from magnetic resonance imaging (MRI)-guided core needle breast biopsies. These features include atypical ductal hyperplasia (ADH), atypical lobular hyperplasia (ALH), flat epithelial atypia (FEA), and lobular carcinoma in situ (LCIS). **Materials and Methods:** A retrospective medical record review was performed on all MRI-guided core needle breast biopsies at a single institution from June 1, 2007 to December 1, 2013 to select biopsies yielding high-risk histopathologic findings. The patient demographics, MRI lesion characteristics, and histopathologic features at biopsy and surgical excision were analyzed. **Results:** A total of 257 MRI-guided biopsies had been performed, and 50 yielded high-risk histopathologic features (19%). Biopsy site and surgical excision site correlation was confirmed in 29 of 50 cases. Four of 29 lesions (14%) were upstaged: 1 case to invasive ductal carcinoma and 3 cases to ductal carcinoma in situ. ADH alone had an overall upstage rate of 7% (1 of 14), mixed ADH/ALH a rate of 75% (3 of 4), ALH alone or with LCIS a rate of 0% (0 of 7), and FEA a rate of 0% (0 of 4). Only mixed ADH/ALH had a statistically significant upstage rate to malignancy compared with the other high-risk histopathologic subtypes combined. No specific imaging characteristics on MRI were associated with an upstage to malignancy on the statistical analysis. **Conclusion:** MRI-guided breast biopsies yielding high-risk histopathologic features were associated with an overall upstage to malignancy rate of 14% at surgical excision. All upstaged lesions were associated with ADH. FEA and ALH alone or with LCIS were not associated with an upstage to malignancy.

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Introduction

The utility of breast magnetic resonance imaging (MRI) has increased significantly during the past decade, becoming increasingly important in the diagnosis and management of breast cancer.[1,2] With the increased sensitivity of breast MRI compared with mammography and ultrasonography, a number of lesions will be detected by MRI alone. However, the low specificity of MRI necessitates MRI-guided biopsy for tissue confirmation of suspicious lesions.[3,4] Several of these biopsies will yield high-risk histopathologic features that will be upstaged to malignancy on subsequent surgical excision. A number of studies have documented upstaging to malignancy for high-risk lesions detected by stereotactic and ultrasound-guided biopsies. Menes et al[5] analyzed the Breast Cancer Consortium data, in which atypical ductal hyperplasia (ADH) had an upstage rate of 18% and lobular neoplasia (atypical

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lobular hyperplasia [ALH] and lobular carcinoma in situ [LCIS]) had an overall upstage rate of 10%. However, data on high-risk lesions from MRI-guided biopsies, including ADH, ALH, flat epithelial atypia (FEA), and LCIS are limited.[6-10]

The purpose of our study was to determine the frequency of high-risk histopathologic features resulting from MRI-guided core needle biopsy, the subsequent upstage rates to malignancy, and whether the imaging characteristics could help predict upstage rates.

Materials and Methods

Case Selection

The institutional review board approved the present Health Insurance Portability and Accountability Act—compliant retrospective review study. The need for patient consent for the present retrospective study was waived by the institutional review board. All MRI-guided core needle breast biopsies at a single institution from January 1, 2007 to December 1, 2013 were retrospectively reviewed using the institution's electronic health record. The database included all suspicious lesions detected by MRI for which MRI-guided biopsy was performed.

Breast MRI Technique and Interpretation at Our Institution

MRI-guided biopsy is reserved for lesions not identifiable by mammography or ultrasonography. MRI biopsy was performed using the Optima MR450w 1.5T MRI (GE Healthcare, Wauwatosa, WI) and a dedicated 8- or 16-channel Sentinelle breast coil (Invivo, Gainesville, FL). Gadolinium-based contrast agents were used at a concentration of 0.1 mmol/kg. From January 1, 2007 to July 1, 2011, gadopentetate dimeglumine (Magnevist; Bayer HealthCare Pharmaceuticals, Montville, NJ) was used. From July 2, 2011 to December 1, 2013, gadobutrol (Gadavist; Bayer HealthCare Pharmaceuticals) was used. Before June 1, 2012, the breast MRI technique at 1.5 T included bilateral axial dynamic 3-dimensional T_1-weighted, fat-suppressed, gradient recalled echo pulse sequences obtained before and after contrast administration. Dynamic images were obtained every 90 to 110 seconds, adjusted for breast thickness, for a total of 6 acquisition times. The slice thickness was 5 mm. Subtraction images were obtained from the dynamic series. Fluid-sensitive T_2-weighted images were also obtained. After December 2011, the slice thickness was reduced to 2 mm. Premenopausal women were imaged on days 7 to 14 of their menstrual cycle for diagnostic images, with the exception of MRI being done for a new diagnosis of breast cancer, in which case they underwent MRI as soon as possible.

All data sets were reviewed using a PACS workstation (DynaCAD, Invivo, or Aegis, Hologic, Bedford, MA) with computer-aided diagnosis for review of lesion enhancement kinetics, multiplanar reconstructions, and maximum intensity projections. The examinations were interpreted with available previous breast imaging and clinical history.

A total of 13 radiologists participated during the study period as the interpreting radiologist. All interpreting radiologists were either fellowship trained in breast imaging or had $>$ 15 years of practice experience. The range of practice experience was 6 to 35 years. The same cohort of interpreting radiologists also performed the MRI-guided core biopsies. The MR images were evaluated and interpreted in accordance with the American College of Radiology Breast Imaging Reporting and Data System (BI-RADS) MR lexicon.[11] Patients with a BI-RADS category 4 or 5 lesion identified by MRI underwent targeted ultrasonography before MRI biopsy at the discretion of the interpreting radiologist. In accordance with convention at our institution, if an ultrasound correlate was identified, the biopsy was performed using ultrasound guidance. If no ultrasound correlate was identified, MRI-guided biopsy was performed. Only lesions biopsied with MRI guidance were included in our study. All patients who underwent MRI at our institution had a recent (within 1 year) diagnostic or screening mammogram available, which was reviewed at MRI interpretation.

MRI-Guided Biopsy Technique

After informed consent was obtained, the patient was positioned prone in a dedicated breast biopsy coil with the breast in compression using a grid device. Unenhanced and contrast-enhanced T_1-weighted images were obtained in the axial plane. After the lesions had been identified on the MRI console, the biopsy images were transferred to a computer with dedicated MRI biopsy software (DynaCad, Invivo, or Aegis, Hologic), and the lesion was targeted. Using a standard biopsy technique,[12] a minimum of six 9-gauge core biopsy samples were obtained using a vacuum-assisted device (Suros ATEC; Suros Surgical Systems, Hologic). Confirmation of lesion targeting and sampling was performed using MRI after introduction of the obturator into the target lesion and after obtaining the biopsy specimens. The number of 9-gauge core biopsy samples obtained was at the discretion of the radiologist performing the biopsy and was to ensure adequate sampling. At least six 9-gauge specimens were obtained. This was similar to the number and gauge used with stereotactic core biopsy. A biopsy marking clip was placed into the biopsy cavity at the conclusion of the biopsy, and a post-procedure mammogram was obtained to verify clip placement. Radiologic—pathologic concordance was determined after a review of the diagnostic images, biopsy images, and postprocedure mammogram by the radiologist who performed the biopsy.

Data Collection and Analysis

The recorded data included the indication for MRI, a personal history of breast cancer, MRI characteristics of the targeted lesion, including MRI lesion size and mass or non-mass enhancement, histopathologic findings from the MRI-guided biopsy, and histopathologic findings from surgical excision of the biopsied lesion.

MRI-guided biopsies yielding benign pathologic results with high-risk histopathologic features of ADH, ALH, LCIS, and FEA were included in the present study. In accordance with institutional practice guidelines, surgical excision was not routinely recommended for papillary lesions; thus, they were not included in our study. The pathology reports were reviewed by a single breast-imaging radiologist. Pathology reports without clear wording regarding the included high-risk diagnoses were then submitted to a breast specialty pathologist for more detailed characterization. Those that did not meet the strict pathologic criteria on MRI-guided biopsy specimens for ADH, ALH, LCIS, or FEA were excluded. The surgical pathology report from any subsequent excision was reviewed for upstaging to malignancy (ductal carcinoma in situ