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Presentation

Correlation of magnetic resonance imaging and pathologic size of infiltrating lobular carcinoma of the breast

Julie Kepple, M.D.[a], Rakhshanda Layeeque, M.D.[a], V. Suzanne Klimberg, M.D.[a,b], Steven Harms, M.D.[c], Eric Siegel, M.S.[d], Soheila Korourian, M.D.[e], Flavia Gusmano, M.D.[a], Ronda S. Henry-Tillman, M.D.[a,*]

[a]*Department of Surgery, Division of Breast Surgical Oncology, University of Arkansas for Medical Sciences, 4301 W. Markham, Slot 725, Little Rock, AR 72205, USA*

[b]*Central Arkansas Veterans Healthcare System, University of Arkansas for Medical Sciences, Little Rock, AR, USA*

[c]*Breast Center of Northwest Arkansas, Fayetteville, Arkansas, and Department of Radiology, University of Arkansas for Medical Sciences, Little Rock, AR, USA*

[d]*Department of Biostatistics, University of Arkansas for Medical Sciences, Little Rock, AR, USA*

[e]*Department of Pathology, University of Arkansas for Medical Sciences, Little Rock, AR, USA*

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Abstract

Background: Determining the extent of infiltrating lobular carcinoma (ILCA) in the breast is difficult. This study was designed to determine if the size of ILCA on magnetic resonance imaging (MRI) correlated with final pathology.

Methods: Retrospective study of patients between 1998 and 2004, who were evaluated for extent of ILCA prior to definitive treatment, was conducted. Demographic data and radiology and pathology results were obtained. Spearman correlation coefficient was used.

Results: Twenty-nine patients (median age 62 years) had MRI of breast. Fourteen patients (48%) had contralateral MRIs; 13 (45%) normal; 1 (8%) prompted core biopsy; 6 of 13 patients underwent contralateral mastectomies, which were benign. The distribution of tumor size was: T1 = 15 (52%); T2 = 7 (24%); T3 = 5 (17%); T4 = 2 (7%). Spearman correlation coefficient between tumor size on ultrasound and MRI with pathology was .19 ($P = .5$) and .88 ($P < .001$), respectively.

Conclusion: MRI provided superior correlation between tumor size and pathology.

Keywords: Magnetic resonance imaging; Infiltrating lobular carcinoma; Breast cancer; Correlation; Staging

Invasive lobular carcinoma (ILCA) constitutes 5% to 20% of breast carcinoma cases [1,2]. Diagnostically, ILCA is challenging because of its veiled presentation on clinical and imaging examination. The indistinctness on physical examination and imaging has been attributed to the histologic characteristics of ILCA, featured by small cells in a linear arrangement with a tendency to grow around ducts and lobules with a relative paucity of desmoplastic response, hemorrhage, necrosis, or calcification [3–5]. This may contribute to ILCAs presenting, in general, as larger lesions than ductal cancers and the fact that ILCAs comprise a greater proportion of breast cancers presenting with a delay in diagnosis than expected [6].

Mammography, which is currently regarded as the most effective and widely used method for early detection of breast cancer [7], is falsely negative in 16% to 3% of ILCA cases [8–10]. Moreover, even when ILCA is detected by mammography, its extent is often underestimated because of its presentation as subtle architectural distortion as opposed to mass effect.

Measurement of tumor size plays a pivotal role in treatment planning of breast cancer. The relationship of the size of

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* Corresponding author. Tel.: +1-501-686-6503; fax: +1-501-526-6191.

E-mail address: henryrondas@uams.edu

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the tumor to the size of the breast is a significant factor for choosing the type of surgery and/or neoadjuvant chemotherapy. Preoperative magnetic resonance imaging (MRI) has emerged as a superior imaging modality for tumor size that may influence therapy [11–13]. In addition, studies comparing MRI with mammography and ultrasound have shown MRI to be most accurate in determining the extent of disease [14,15]. Therefore, it is intuitive that preoperative MRI would allow better surgical planning effecting adequate margins, potentially reducing the rate of reoperation and local recurrence.

The objective of the current study was to determine the accuracy of gadolinium-enhanced 3-dimensional (3-D) rotating delivery of excitation off-resonance (RODEO) MRI in delineating the extent of ILCA, employing pathologic size as the gold standard.

Methods

Study design and patients

An institutional review board–approved, retrospective study was performed of all patients who underwent MRI to evaluate the extent of disease within the breast prior to definitive surgical treatment for ILCA at the University of Arkansas from July 1998 through June 2004. The diagnosis of ILCA of the breast was made by either core or incisional biopsy. All MRIs were performed using the gadolinium-enhanced 3-D RODEO technique.

MRI technique

The 3-D RODEO technique MRI protocol has been described previously [16]. The breast MRI is performed using a 1.5-T GE Signa (General Electric Medical Systems, Milwaukee, WI) with 5X and 9X software (General Electric Medical Systems). A 3-D RODEO acquisition imaging sequence with a sine excitation on fat resonance followed by a similar 180-degree phase-shifted sine excitation was used to image the breast prior to and following gadolinium administration (0.1 mmol/kg). The RODEO sequence is used to provide robust excitation of water resonance, suppression of fat resonance, and magnetization transfer contrast suppression of fibroglandular tissue. The nearly isotropic display matrix ($1024 \times 256 \times 128$) allows reformation of images in any plane from the 3-D data without a perceptible loss in resolution. Pre-contrast nonspoiled, immediate post-contrast spoiled, and delayed post-contrast spoiled images were generated. MRI findings reported consisted of documenting the pattern of enhancement, 3-D size of the lesion, and its position within the breast. All MRIs were read by a board-certified, MRI-dedicated breast imaging radiologist (S.E.H.).

The RODEO sequence differs from other commonly used breast MRI methods in the ability to provide improved contrast and resolution. As opposed to other fat suppression sequences, RODEO does not require preparation pulses that increase the scan time and introduce artifacts. In effect, the RODEO sequence excites water and selectively does not excite fat. Other methods excite fat and then attempt to suppress the signal. Ductal tissue often is hyperintense and can be difficult to separate from malignancy on other sequences. RODEO uses off-resonance excitation of the protein-bound water (magnetization transfer contrast) to effectively reduce the ductal tissue signal. To perform magnetization transfer contrast with other breast MRI methods requires the addition of another preparation pulse, which lengthens the scan time and introduces image artifacts. Most breast MRI methods attempt to overcome the inefficient pulse sequences by alternative reconstruction methods. The trade-offs for these alternative reconstructions are image blurring, lower resolution, and reduced contrast. The efficiency of RODEO not only allows consistently pure contrast from projection to projection, but also allows the reconstruction of nearly isotropic voxels (equal dimensions in all 3 planes). Isotropic voxels allow image reformations in any desired plane from the original 3-D data. Typically, breast MRI images are gathered in a combination of sagittal, axial, or coronal images. The breast, however, is not anatomically oriented in orthogonal planes. With RODEO, images can be calculated retrospectively in radial planes with the nipple at the apex. Since the data are isotropic, there is no loss in resolution when these oblique slices are calculated.

Data collection

Patient records were reviewed for the following factors: (1) demographics; (2) presentation of tumor; (3) details of radiologic studies, including mammogram, ultrasound, and MRI; and (4) pathologic size of tumor. The patients medical record, radiology and pathology database, and tumor registry was used to complete the data collection.

Data analysis

All data was entered and analyzed using statistical software (Microsoft Excel software, Redmond, WA). Tumor dimensions of the index lesion as reported on mammogram, ultrasound, and MRI were evaluated against final pathologic size using Spearman correlation coefficient using statistical package of Microsoft Excel software.

Results

Patients

One thousand one patients underwent treatment for invasive breast cancer at our institution during the study period. Seventy-nine patients (8%) were diagnosed with ILCA. Twenty-nine of these (37%) who were evaluated