Original Investigation

Potential Use of American College of Radiology BI-RADS Mammography Atlas for Reporting and Assessing Lesions Detected on Dedicated Breast CT Imaging: Preliminary Study

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Rationale and Objectives: Dedicated breast computed tomography (DBCT) is an emerging and promising modality for breast lesions. The objective of this study was to evaluate the potential use of applying the BI-RADS Mammography Atlas 5th Edition for reporting and assessing breast lesions on DBCT. Currently, no atlas exists for DBCT.

Materials and Methods: Four radiologists trained in breast imaging were recruited in this institutional review board-approved, Health Insurance Portability and Accountability Act-compliant study. The enrolled radiologists, who were blinded to mammographic and histopathologic findings, individually reviewed 30 randomized DBCT cases that contained marked lesions. Thirty-four lesions were included in this study: 24 (70.6%) masses, 7 (20.6%) calcifications, and 3 (8.8%) architectural distortions. Eight (23.5%) lesions were malignant and 26 (76.5%) were benign. The reader was asked to specify according to the BI-RADS Mammography Atlas for each marked DBCT lesion: primary findings, features, breast density, and final assessment. We calculated readers' diagnostic performances for differentiating between benign and malignant lesions and interobserver variability for reporting and assessing lesions using a generalized estimating equation and the Fleiss kappa (κ) statistic.

Results: The estimated overall sensitivity of the readers was 0.969, and the specificity was 0.529. There were no significant differences in the sensitivity and the specificity between lesion types. For reporting the presence of a primary finding, the overall substantial agreement ($\kappa = 0.70$) was seen. In assigning the breast density and the final assessment, the overall agreement was moderate ($\kappa = 0.53$) and fair ($\kappa = 0.30$).

Conclusion: The use of the BI-RADS Mammography Atlas 5th Edition for DBCT showed high performance and good agreement among readers.

Key Words: Breast neoplasm; breast CT; BI-RADS; mammography.

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INTRODUCTION

Breast Imaging Reporting and Data System (BI-RADS), established by the American College of Radiology, was begun in the late 1980s to address a lack of standardization and uniformity in mammography practice and reporting (1), and the BI-RADS lexicon has provided a valuable and reliable guide for reporting breast lesions on mammography, ultrasound, and magnetic resonance imaging (MRI), and has been familiar to most radiologists specializing in breast imaging. The descriptors in the BI-RADS lexicon have been selected on the basis of their ability to discriminate between benignity and malignancy as clear and standardized terms (2,3). BI-RADS has also recommended that a final impression be summarized by choosing only one among several standardized final assessment categories at the end of a report, each of which included a matched, standardized management recommendation (4,5). The BI-RADS atlas is intended to be a "living" document that changes as new data are acquired and more sophisticated patterns of breast care emerge (4). With continued evolvement of lesion characterization and assessment for malignancy, the BI-RADS Mammography Atlas is now in its fifth edition (6).

In addition to the updates in mammography, the fifth edition contains standardized breast lesion lexicons and assessment language for breast ultrasound and MRI. With advancements in breast imaging technologies, such as dedicated computed tomography of the breast, the BI-RADS Mammography Atlas can serve as the standard terminology upon which lexicons in other areas of radiology and research can be modeled.

Mammography is the current gold standard for detecting breast cancer in asymptomatic women and has been proven to decrease mortality (7–9). However, this technology does have some limitations because of the superimposition of anatomic structures. In women with dense breasts, mammography has not been proven as sensitive as in the population of women with nondense breasts (10,11). In reaction to this problem, dedicated breast computed tomography (DBCT), which provides three-dimensional data that can be reconstructed into multiple imaging planes, similar to breast MRI, has emerged as a new imaging modality in some researchers (12–31). DBCT is performed without breast compression and is not as limited as full-field digital mammography or digital breast tomosynthesis by breast density or breast implants (14,15,17). The radiation dose level is similar to the dose of a conventional two-view digital mammogram (23,24,26,28). Since the initial clinical experience of DBCT was begun by Lindfors in 2008 (23), DBCT has showed promising results for the diagnostic evaluation of breast lesions, particularly for breast masses (12,20,25–29,31). Published articles have shown that DBCT has shown a significant improvement in the characterization or differentiation of breast lesions using BI-RADS descriptor and category terminology compared to digital mammography (20,31). However, to our knowledge, there is no published study about the reproducibility of readers for reporting and assessing breast lesions on DBCT with the use of BI-RADS. Determining the reproducibility of BI-RADS is important because it can offer standardized guidance in reporting and assessing breast lesions with DBCT. Currently, no atlas exists for DBCT.

The purpose of the present study was to evaluate the diagnostic performance and the variability of multireaders for the use of the BI-RADS Mammography Atlas 5th Edition in reporting and assessing breast lesions on DBCT.

MATERIALS AND METHODS

Institutional review board approval was obtained for this radiologist reader study. Informed verbal and written consent was obtained from all of the readers involved in the present study. The deidentified DBCT cases that were used in the current study were from a DBCT image database of collected cases from two other institutional review board-approved, Health Insurance Portability and Accountability Act-compliant DBCT clinical trials. A total of 34 lesions in 30 subjects were identified in the database and are included in our study. All the lesions in the database had been assessed as BI-RADS 4 or 5 lesions with standard of care imaging, which consisted of full-field digital mammography and their pathologic diagnoses based on image-guided percutaneous core needle biopsy or surgical excision. All lesions were mammographically evident on standard of care diagnostic evaluation. Pathologic results for all lesions were evaluated with image-guided percutaneous core biopsy. In cases referred for excisional biopsy after needle core biopsy because of the finding of atypia, malignancy, or radiology-pathology discordance, final surgical pathologic analysis was used for correlation with imaging findings. At our institution, our protocol for breast lesions that result in a diagnosis of atypia on needle core biopsy was to perform surgical excision to exclude histologic underestimation.

Before the reader study, each lesion for each case was electronically marked and numbered on the images by the principle investigator, who was familiar with the clinical, mammographic, and pathologic information of each case in the study.

Readers

Eligible radiologists were identified by research staff review of their credentials from academic practice centers. A total of four fellowship trained breast imaging radiologists were recruited and enrolled in the present study. The readers had 1–13 years (mean of 7 years) of clinical experience and use of the BI-RADS Mammography Atlas. According to self-reports of the radiologists, they interpreted at least 140 mammography examinations (80–180) per week on average. The readers had no experience of DBCT imaging as part of their daily practice. To minimize reader bias, these breast imaging radiologists possessed no conflicts of interest in the research study or with the use of the device.

Data Description

Table 1 shows the cross-tabulation for the mammographic lesion types and pathology of the 34 lesions. The 34 lesions