Original Investigation

Focal Breast Pain: Does Breast Density Affect the Need for Ultrasound?

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Rationale and Objectives: This study aimed to determine the utility of directed ultrasound and digital mammogram for evaluating focal breast pain in women with different mammographic breast densities.

Materials and Methods: This institutional review board–approved and Health Insurance Portability and Accountability Act–compliant retrospective study included 413 cases of focal breast pain in 369 women (mean age 53 years). All cases were evaluated with both mammogram and ultrasound and had at least 2 years of imaging follow-up. Exclusion criteria were non-focal, axillary, or radiating pain; palpable or skin changes; pregnancy or lactation; and history of trauma or infection. Breast density, imaging findings, and biopsy results were recorded. Specificity, positive predictive values, and negative predictive values were calculated.

Results: Eighteen percent (76 of 413) of cases demonstrated an imaging correlate. Of these, 74% (56 of 76) occurred in dense breasts and 26% (20 of 76) in nondense breasts. Seventy percent (14 of 20) of lesions in nondense breasts were seen with mammography and ultrasound, whereas 30% (6 of 20) were detected only with ultrasound. Of lesions detected in dense breasts, 29% (16 of 56) were seen with mammography and ultrasound, whereas 71% (40 of 56) were detected only with ultrasound. Thirty-one percent (24 of 76) of cases were biopsied, 42% (10 of 24) of which were detected by ultrasound only. No cancer was detected in initial workup. At 2-year follow-up, three women, all with dense breasts, developed cancer in the same quadrant as the initial pain.

Conclusions: Directed ultrasound, when performed in conjunction with digital mammography for the evaluation of focal breast pain in women with nondense breasts, is of low utility and may contribute to unnecessary intervention as a result of incidental findings.

Key Words: Focal breast pain; mammographic breast density; targeted ultrasound; full-field digital mammography; breast cancer.

INTRODUCTION

Breast pain is one of the most common symptoms for which women seek medical care (1–8). Although up to 80% of women experience breast pain at some point in their lives, most commonly breast pain results from a benign etiology including idiopathic causes, simple cysts, trauma, infection, pregnancy, or lactation (5,9). In contrast, breast cancer is reported in up to 4% of women presenting with focal breast pain (1,4,10–16). Despite the uncommon association between breast cancer and focal breast pain, a diagnostic imaging workup can be requested (17). Current American College of Radiology Appropriateness Criteria guidelines rate the use of mammography and ultrasound for the evaluation of noncyclical, focal, unilateral, or bilateral breast pain in patients 30 years and older as "may be appropriate"; in women under 30, ultrasound is rated "may be appropriate" and mammography is rated "usually not appropriate" (5). Traditionally, both mammography and ultrasound are performed in women older than 30 years, who present with noncyclical, focal breast pain as imaging can often exclude a treatable benign cause of pain and/or provide reassurance (5,18).

However, current recommendations for imaging primary focal breast pain are controversial owing to the overall paucity of data limited by small sample sizes and short follow-up intervals (5). Furthermore, most studies include data obtained from film screen mammography, which has been replaced by digital mammography as the standard of care (1,10,12,14,19) (Table 1). One study to date has evaluated the utility of mammography over long follow-up intervals (average: 51 months), but this study included both screen film and digital mammograms (11). To our knowledge, there is no published work evaluating the utility of directed breast ultrasound in combination with digital mammography in a large study population over a long follow-up period. In addition, none of the previous work has assessed the utility of ultrasound in the setting of focal breast pain among women with different mammographic breast densities.

The purpose of this study was to determine the long-term outcomes and utility of digital mammography and directed ultrasound in the workup of primary focal breast pain and assess whether findings differed among women with mammographically dense and nondense breasts.

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TABLE 1. Summary of Literature

Author	Year	Cohort (*N*)	Mean Duration of Follow-up (mo)	No. of Cases with Benign Imaging Findings *N* (%)	No. of Cases with Breast Cancer *N* (%)
Duijm et al.	1998	987	48	129 (13)	4 (0.4)
Leddy et al.	2013	257	12	117 (46)	3 (1)
Tumyan et al.	2005	86	26.5	82 (95)*	4 (4.7)†
Masroor et al.	2009	55 (5 focal pain)	48	38 (69)	0 (0)
Noroozian et al.	2015	617 (304 focal pain)	51	63 (10.2)	11 (1.8)
Leung et al.	2002	110	29	25 (23)	0 (0)

* Includes both benign and negative cases.

† Two at the site of focal pain and two incidental malignancies remote from the site of focal pain.

MATERIALS AND METHODS

Patient Inclusion and Exclusion Criteria

We retrospectively reviewed 3411 consecutive cases of primary breast pain evaluated by digital mammography and directed ultrasound over a 6-year period from December 2006 to April 2013. Women with primary focal breast pain, who were initially evaluated with both digital mammography and directed ultrasound, and who underwent at least 2 years of breast imaging follow-up ($n = 2415$), were included. Primary focal breast pain is defined as pain within one breast quadrant that is localizable by one finger and whose presentation is not associated with other symptoms. Women who presented with diffuse, radiating, or axillary pain ($n = 220$), associated palpable findings at the site of pain ($n = 1301$), skin changes (erythema, thickening) ($n = 74$), or nipple changes (discharge, retraction) ($n = 81$) were excluded. Women who were either pregnant or breast-feeding ($n = 165$), reported a history of recent trauma or infection of the affected breast ($n = 96$), or had a history of ipsilateral breast cancer ($n = 285$) were also excluded. Each site of reported focal pain was classified as an independent case. For instance, if one patient reported an area of focal pain in the upper outer quadrant of the left breast and an area of focal pain in the lower outer quadrant of the left breast, both sites of focal pain were included as two separate cases. Additionally, each incidence of reported focal pain was classified as an independent case. The final study group consisted of 413 cases in 369 women (Fig 1).

Imaging Technique

The routine diagnostic workup included full-field digital mammograms (GE Senographe Essential, Siemens Novation) in the craniocaudal and mediolateral oblique views of both breasts, as well as spot compression magnification views of the site of focal pain. Directed ultrasound was then performed by a fellowship-trained breast imaging radiologist in the area of focal breast pain (Siemens Acuson S2000, Siemens Antares P.E., Acuson Sequoia 512, Philips Epiq). All examinations were interpreted by fellowship-trained breast imaging radiologists with 8–22 years of experience. No new interpretations of the diagnostic imaging were performed for the purposes of this study.

Data Collection

We reviewed the electronic medical record including clinical notes, diagnostic radiology reports, and pathology reports for each case to record patient age and any history of breast cancer, benign breast disease, or breast interventions.

We reviewed digital mammogram and ultrasound reports from the date of initial presentation for breast density, location and extent of breast pain, findings correlating with focal pain, and incidental imaging findings. An incidental finding is defined as a lesion in the imaging field of view that is not directly subjacent to the focal area localized by the patient. For example, a patient has focal pain at 3:00 but an incidental simple cyst is noted at 5:00 during scanning. Breast density is defined as nondense (predominately fatty and scattered fibroglandular) or dense (heterogeneously dense and extremely dense) on digital mammography based on classifications from the fourth edition of the Breast Imaging-Reporting and Data System (BI-RADS) lexicon (20). BI-RADS 3, 4, or 5 findings (ie, findings with a greater than 2% risk of malignancy) incidentally seen only on ultrasound were also recorded. We reviewed all follow-up breast imaging reports for subsequent cancer development in the same quadrant as the initial focal pain. In addition, we reviewed pathology reports to correlate histopathology with imaging findings if a biopsy was performed at the site of focal breast pain either at the time of initial presentation or later. We also correlated histopathology with BI-RADS 4 or 5 findings incidentally seen by ultrasound.

Data Analysis

The specificity and negative predictive value (NPV) of digital mammogram and directed ultrasound for the detection of breast cancer at the site of focal breast pain were calculated. True-positive values included cases with imaging findings that were biopsied and demonstrated breast cancer (invasive breast cancer