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Ultrasound screening of contralateral breast after surgery for breast cancer

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ABSTRACT

Objective: To determine whether supplemental screening ultrasound (US) to mammography could improve cancer detection rate of the contralateral breast in patients with a personal history of breast cancer and dense breasts.

Materials and methods: During a one-year study period, 1314 screening patients with a personal history of breast cancer and dense breasts simultaneously underwent mammography and breast US. BI-RADS categories were given for mammography or US-detected lesions in the contralateral breast. The reference standard was histology and/or 1-year imaging follow-up, and the cancer rate according to BI-RADS categories and cancer detection rate and positive biopsy rate according to detection modality were analyzed.

Results: Of 1314 patients, 84 patients (6.4%) were categorized as category 3 with one interval cancer and one cancer which was upgraded to category 4A after 6-month follow-up US (2.5% cancer rate, 95% CIs 1.5–9.1%). Fifteen patients (1.1%) had category 4A or 4B lesions in the contralateral breast. Four lesions were detected on mammography (two lesions were also visible on US) and 11 lesions were detected on US and 5 cancers were confirmed (33.3%, 95% CIs 15.0–58.5%). Six patients (0.5%) had category 4C lesions, 2 detected on mammography and 4 on US and 4 cancers were confirmed (66.7%, 95% CIs 29.6–90.8%). No lesions were categorized as category 5 in the contralateral breast. Cancer detection rate by mammography was 3.3 per 1000 patients and that by US was 5.0 per 1000 patients, therefore overall cancer detection rate by mammography plus US was 8.3 per 1000 patients. Positive biopsy rate of mammography-detected lesions was 66.7% (4 of 6) and that of US-detected lesions was 40.0% (6 of 15).

Conclusion: US can be helpful to detect mammographically occult breast cancer in the contralateral breast with high positive biopsy rate and low category 3 rate in patients with a previous history of breast cancer and dense breasts.

1. Introduction

It is well known that patients who are diagnosed with breast cancer are at increased risk of developing contralateral breast cancer as well as loco-regional recurrence. The incidence of contralateral breast cancer has been reported to range from 0.5% to 1.0% per year and the cumulative risk at 20 years was as high as 15.4% [1,2].

Surveillance for metachronous contralateral breast cancer after a diagnosis of unilateral breast cancer typically consists of yearly mammography and physical examinations at 3–6 month intervals [3]. However, mammography is known to be less sensitive in younger, dense breasts and showed poor sensitivity for the surveillance of contralateral breast cancer in early-onset breast cancer patients, so better imaging modalities are required to detect new contralateral breast cancer in patients with increased risk and dense breasts [4–8]. Meantime, the detection of isolated loco-regional or contralateral breast cancer recurrences in asymptomatic patients has beneficial impact on survival of breast

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cancer patients when compared to late symptomatic detection [9].

Several studies have reported that supplemental screening ultrasound (US) after mammography can detect mammographically occult cancers in dense breasts [5,10,11]. Especially for women with an elevated risk of breast cancer, supplemental US examination to mammography increases the detection of small, node-negative cancers, with additional cancer detection 4.2 cancers per 1000 patients [11]. However, it substantially increased the number of false positives and the positive predictive value of biopsy recommendation was 23% for mammography and 9% for US [11]. In addition, it detected many Breast Imaging Reporting and Data System (BI-RADS) 3 probably benign findings that require additional short-interval follow-up [12]. There were a few studies about US surveillance outcome on postoperative patients and the results showed that US can contribute to the early detection of recurrent breast cancers irrespective of lesion location [13,14]. Also in some reports comparing the diagnostic role of mammography and US, US showed superior role in detecting contralateral breast cancer [15] and ipsilateral or contralateral breast recurrence irrespective of lesion palpability [16]. BI-RADS US lexicon and final assessment has been used to assess US-detected lesions to compare the cancer detection rate and positive biopsy rate for screening mammography alone and combined mammography and US [17]. However, few studies have focused on the additional role of screening US to mammography in the contralateral breast based on BI-RADS assessment [18].

The purpose of this retrospective study was to determine whether supplemental screening US to mammography could improve cancer detection rate of the contralateral breast in patients with a personal history of breast cancer and dense breasts.

2. Materials and methods

2.1. Study population

This retrospective study was approved by the institutional review board and informed consent was waived. Patients were eligible to participate in the study if they had a personal history of breast cancer more than one year prior to the US study, had no signs or symptoms of breast abnormalities, and had normal clinical examination. All participants were to undergo mammography and physician-performed breast US on the same day. We searched the computerized database in 2006 and found 1314 consecutive asymptomatic patients who met our inclusion criteria.

2.2. Surveillance and imaging interpretation

In our hospital (academic medical center), screening US was done for patients with dense breasts (mammographic density 3–4 with over 50% glandular tissue) and patients with an elevated risk of breast cancer such as patients with a personal history of breast cancer. Before breast US examinations, digital 2D mammography was done for the patients and standard 4-view mammograms were interpreted by the radiologist who performed US. The breast density assessment was performed by visual assessment not by computerized software. According to BI-RADS lexicon, breast composition was assessed by the following patterns: (1) The breasts are almost entirely fatty (<25% glandular). (2) There are scattered areas of fibroglandular density (approximately 25–50% glandular). (3) The breast tissue is heterogeneously dense, which may obscure small masses (approximately 51–75% glandular). (4) The breast tissue is extremely dense, which lowers the sensitivity of mammography (>75% glandular) [17]. Commercial CAD system for mammography was applied for some of them not for all of them because the CAD system was applied only for images obtained by Senographe 2000D FFDM (GE Medical Systems, Milwaukee, WI, USA) unit. Hand-held breast US was performed by one of the five radiologists with 5–20 years of experience with US machines (HDI 5000; Philips ATL, Bothell, WA or LOGIQ 9; GE Medical Systems, Milwaukee, WI, USA) using a linear 5–12 MHz transducer. Breast US was done for bilateral whole breasts and axillary regions in radial and anti-radial planes and/or transverse and sagittal planes. For some cases, color Doppler was applied for evaluation of vascularity before final categorization of US-detected breast lesions. Each radiologist prospectively evaluated the characteristics of US-detected breast lesions and gave a final assessment according to BI-RADS [17]. Since 2005, BI-RAD US lexicon was routinely used in clinical practice in this institution and the criteria for final assessment for US-detected lesion have been reported [18]. US lesions classified as BI-RADS category 3 could not have suspicious features and included US features such as oval shape, parallel orientation, circumscribed margin, no posterior features or minimal posterior enhancement, isoechoic or hypoechoic patterns, etc. [17,19]. In the cases of patients with multiple breast lesions, the lesion with the most serious finding was used for final assessment. The radiologist who performed US recorded whether the lesion was detected on mammography or on US.

We reviewed the final reporting record for all patients and recorded the BI-RADS category for the contralateral breast.

2.3. Patient management

Patients with negative or benign findings (BI-RADS category 1 or 2) were recommended for routine follow-up. Patients with probably benign findings (BI-RADS category 3) were recommended for short term follow-up at 6 months. Patients with BI-RADS category 4 or 5 lesions were recommended for biopsy. In rare cases, however, biopsy was performed due to the demand of the patient or physician irrespective of BI-RADS category.

Tissue sampling was done with an US-guided core needle biopsy with 14-gauge needles (Bard Peripheral Vascular/Bard Biopsy Systems, Tempe, AZ, USA) or an 11-gauge vacuum-assisted device (Mammotome; Johnson & Johnson, Cincinnati, OH, USA) and mammography-guided biopsy with 11-gauge vacuum-assisted device for the lesions visible only on mammography.

2.4. Data analysis

One radiologist reviewed all the imaging and medical reports. Reference standard was based on biopsy results and/or 12-month follow-up. Any lesion with abnormal findings on mammography was defined as mammography-detected whether or not it was also visible on US. The lesions that had negative finding on mammogram but were detected on US were defined as US-detected. For each BI-RADS category, the cancer rate (the number of cancer cases divided by the total number of cases) was calculated with 95% confidence intervals (CIs). Cancer detection rate per 1000 patients, biopsy rate and positive biopsy rate (how often biopsies done are cancer, PPV_3) were calculated according to imaging modalities.

For all biopsied lesions, we recorded the pathology and for malignant cases, we also recorded clinical findings such as age at diagnosis of contralateral breast cancer, previous operation method, TNM staging of previous cancer, interval from first operation to diagnosis of contralateral breast cancer and detection modality of contralateral breast cancer, density at mammography and BI-RADS category and the pathologic findings such as histologic type, tumor size, histological grade, and nodal status.