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The Influence of Radiology Image Consultation in the Surgical Management of Breast Cancer Patients

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Abstract

Background—Patients referred to comprehensive cancer centers arrive with clinical data requiring review. Radiology consultation for second opinions often generates additional imaging requests, however the impact of this service on breast cancer management remains unclear. We sought to identify the incidence of additional imaging requests and the effect additional imaging has on patients' ultimate surgical management.

Methods—Between November 2013 and March 2014, 153 consecutive patients with breast cancer received second opinion imaging reviews and definitive surgery at our cancer center. We identified the number of additional imaging requests, the number of fulfilled requests, the modality of additional imaging completed, the number of biopsies performed, and the number of patients whose management was altered due to additional imaging results.

Results—Of 153 patients the mean age was 55; 98.9 % were female; 23.5% (36) had in situ carcinoma (35 DCIS/ 1 LCIS) and 76.5% (117) had invasive carcinoma. Additional imaging was suggested for 47.7% (73/153) of patients. After multi-disciplinary consultation, 65.8% (48/73) of patients underwent additional imaging. Imaging review resulted in biopsy in 43.7% (21/48) of patients and ultimately altered preliminary treatment plans in 37.5% (18/48) of patients. (Figure 1) Changes in management included: conversion to mastectomy or to breast conservation, neoadjuvant therapy, additional wire placement, and need for contralateral breast surgery.

Conclusions—Our analysis of second opinion imaging consultation demonstrates the significant value this service has on breast cancer management. Overall, 11.7% (18/153) of patients who underwent breast surgery had management changes as a consequence of radiologic imaging review.

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Keywords

Breast Surgery; Surgical Oncology; Breast Neoplasms; Additional Imaging; Changes in Management

INTRODUCTION

Contemporary breast cancer diagnosis and therapy is multidisciplinary, with individual patient treatment decisions requiring the expertise of medical professionals from various disciplines. With over 230,000 women expected to be diagnosed with breast cancer in the United States in 2015, effective and efficient processes for diagnosis and treatment are necessary to ensure quality care and outcomes.¹⁻³ The complexity of breast cancer care has given rise not only to an increasing reliance on breast specialists from a variety of disciplines, but also to the development of multidisciplinary forums in which coordinated discussions can occur. The comprehensive cancer center (CCC) model recognizes that present-day management requires care decisions that cross specialties, and it is structured to foster multidisciplinary collaboration that espouses to provide optimal patient care.

CCCs serve many patients who are initially diagnosed with malignancy in the community setting. Patients referred to these centers routinely arrive with an array of pathologic and radiographic data acquired during their initial diagnostic workup, which must then be analyzed by the CCC's multidisciplinary team of clinicians including surgeons, medical oncologists, radiation oncologists, radiologists and pathologists. Additional diagnostic testing and imaging may be requested and performed after review by the care team, and diagnosis as well as treatment decisions may be altered as a result. The process by which outside imaging is reviewed at CCCs is not well studied, and we have limited knowledge regarding not only the frequency with which additional imaging is performed but also the impact these additional studies may have on the treatment pathway of breast cancer patients.

We sought to understand the effect second opinion imaging has in the breast cancer treatment pathway, specifically to determine the frequency of additional imaging requests made by breast imagers and the impact the results of these studies have on the final treatment plans as determined by the multidisciplinary team.

METHODS

This study was undertaken as a quality improvement project and was determined to be exempt from review by the Dana-Farber/Harvard Cancer Center Institutional Review Board.

SETTING

The Dana-Farber Brigham and Women's Cancer Center (DF/BWCC) offers comprehensive cancer care services for the full range of hematologic and solid tumor malignancies. The breast cancer program is organized as a multidisciplinary disease center with a strong clinical trials focus and offers service to over 3,000 new patients annually. The center features breast specific specialists as follows: 26 medical oncologists, 12 surgical

oncologists, 12 radiologists, 6 pathologists, and 5 radiation oncologists who practice across 5 ambulatory sites.

SECOND OPINION IMAGING PROGRAM

The second opinion radiology program was established at our primary ambulatory consultation site in 2010 in order to enhance multidisciplinary patient care by providing concurrent radiology review for new patients referred from outside institutions. Prior to its inception, breast surgical oncologists obtained second opinions from breast imagers informally on an ad hoc basis. As part of this program, a dedicated breast imager spends five half-days per week reviewing breast images in real-time of new patients in an en-suite radiology reading room in the multidisciplinary clinic. All outside imaging on digital media is uploaded to the institution's PACS (Picture Archiving and Communication System), and printed films are displayed on a mammography view box. Breast imagers record their interpretations of outside studies and their recommendations for additional radiologic workup on standardized imaging consult forms. These forms, while not stored in the electronic medical record, are uploaded into a secure and password-protected online workspace and multidisciplinary meetings are held among those caring for the patient with the breast imaging experts to determine plans of care. For patients offered breast conserving therapy (BCT) versus mastectomy, the patients' preferences are factored in, and a final decision is made regarding the necessity of further imaging by the care team.

COHORT SELECTION AND ANALYSIS

We identified 214 consecutive patients who were referred to DF/BWCC from outside institutions and received a second opinion imaging review between November 2013 and March 2014. We subsequently excluded 61 patients, including 19 patients who did not have a definitive breast cancer diagnosis (invasive or in situ) at initial consultation and 42 patients who did not receive care at our center.

The breast imaging consult forms for the remaining 153 patients were reviewed to determine the number of patients who had additional imaging requested. Retrospective medical chart reviews were conducted to determine the number of requests ultimately fulfilled after multidisciplinary review, the modality of the additional imaging completed, the number of biopsies performed and the biopsy results. Finally, the number of patients whose management was altered due to additional imaging results was determined by comparing the care plan at initial consultation with the care plan after the additional imaging studies were conducted. We also calculated the interval time between the initial multidisciplinary consultation and the date the additional imaging was performed. The date of the last imaging study was used in cases for patients who underwent more than one additional imaging test.

RESULTS

A total of 153 patients with breast cancer who underwent surgery at our center were evaluated by our second opinion radiology program. The mean age was 55 and 98.9% were female; 23.5% (36) of patients had in situ carcinoma and 76.5% (117) of patients had invasive carcinoma at initial consultation.

As shown in Figure 1, additional imaging was recommended by the breast radiologists in 47.7% of cases (73/153). After consultation between the breast imager and the multidisciplinary care team, additional imaging was performed in 65.8% (48/73) of the requested cases. Diagnostic mammography was the most common form of additional imaging conducted, followed by ultrasound and breast MRI (Table 1). Second opinion review resulted in biopsy in 43.7% (21/48) of patients receiving additional imaging. We found that 33.3% (7/21) of patients undergoing biopsy had additional foci of cancer identified away from the index lesion(s) (Table 2).

The additional imaging and/or biopsy performed led to changes in the preliminary treatment plans in 37.5% (18/48) of patients who underwent additional imaging. Changes in care management were observed in patients who only had imaging studies performed (n=5) as well as in those who had biopsy performed (n=13). These changes in care management included conversion to mastectomy (n=6), additional wire placement during BCT (n=5), and conversion to BCT (n=4) (Table 3). Three patients had other changes in care, including initiating neo-adjuvant chemotherapy (n=1), contralateral wire localization (n=1) and ultrasound-guided fine needle aspiration of axilla (n=1).

The mean number of days between initial consultation and when the imaging was performed was 6 (range 0–34, STD 8).

DISCUSSION

Although patients who present to CCCs often have a large portion of their diagnostic workup completed, the extent and accuracy of this workup is variable. Review of outside studies can be both costly and resource intensive, and the ultimate effect of recommendations resulting from second opinions on patient management is not well established. The multidisciplinary care model rests upon providing consultations that employ an efficient but thorough review of outside studies, including second opinion reviews when indicated, in combination with specialist discussions to provide final management recommendations. Our institution implemented a formal second opinion radiology program for patients presenting to our clinics in 2010, with the hypothesis that this service would enhance local therapy decision-making, ultimately improving patient care and outcomes.

The rationale behind our second opinion breast radiology review program is supported by prior research examining the impact of multi-specialty management in the breast cancer treatment pathway. Previous studies documented the benefits of multidisciplinary breast clinics, which included not only improved patient satisfaction but also decreased delays between diagnosis and treatment; subsequent research has highlighted the importance of subspecialty second opinion review in improving patient outcomes.^{4–5} Geller et al. found that 96% of surveyed pathologists felt that second opinions improved diagnostic accuracy on breast cases, corroborating the findings of the prior work by Staradub et al., which found that second opinion breast pathology review provided additional prognostic information in 40% of cases and altered management in close to 8% of study participants.^{6–7}

Research performed at two National Comprehensive Cancer Network (NCCN) designated sites further explored the role of multidisciplinary review in altering clinical management of patients with breast disease. Chang et al. found that multidisciplinary tumor board review of 75 patients with benign or malignant breast disease led to a recommended change in treatment of 42.7% of cases,⁸ and a subsequent larger study by Newman et al. focusing exclusively on 149 breast cancer patients similarly identified that multidisciplinary discussion with pathology, radiology, and clinical review led to a significant number of changes in recommended management plans (51.7%).⁹ Second opinion radiology review (and the additional imaging studies performed as result) accounted for 11% of these management alterations.⁹

Whereas the works by Newman et al. and Chang et al. focused on the changes in recommended management offered from multidisciplinary review of patients with breast lesions, only one other study, to our knowledge, has exclusively examined the role of second opinion radiology review on the recommended and actual surgical management of patients with breast lesions. This work, done by Spivey et al., at Rush University Medical Center found that 53.5% of patients whose breast imaging was reviewed by their dedicated breast imagers required either additional imaging or biopsy, with 27.1% of cases leading to changes in overall management.¹⁰ The higher percentage of patients identified with actual changes in surgical management in the Spivey study compared to ours may be in part accounted for by the fact that they included patients with non-cancer diagnoses in their cohort, increasing the likelihood of changing management. Furthermore, in our study, we considered a 'change in surgical management' as a change in surgical procedure, and did not consider biopsy alone to be part of this definition. Lastly, while the Spivey study included all patients regardless of whether their treatment was completed at their institution, we focused exclusively on patients who completed definitive breast surgery at our center. Table 4 displays a comparison of our study alongside those by Newman et al., Chang et al., and Spivey et al.

Our current study further demonstrates the known variability among radiologists' interpretations of mammograms, reported differences in interpretative accuracy among existing mammography facilities, and evidence suggesting that breast cancer is more apt to be detected by specialists in breast imaging than by non-specialists.^{8, 11-14} This was highlighted in a study done by Sickles et al. examining performance parameters for radiologists on 61,084 consecutive mammographic studies which found that cancer detection rates by breast imaging specialists was more than 1.5 times that of general radiologists.¹³

In our study, breast radiologists recommended additional imaging in 47.7% of cases they reviewed, frequently recommending additional mammograms, ultrasounds, and occasionally MRIs to assist with treatment decisions. Reasons for imaging requests included but were not limited to the need for additional views of incompletely imaged or newly identified areas of concern, need for contralateral imaging, and need for post-clip placement films. Radiology recommendations for additional imaging were made by breast imagers prior to multidisciplinary discussion, however, and the decision on whether to obtain or defer further imaging took place in the setting of a team meeting, as only 65.8% of patients recommended

to have further imaging actually had these studies completed. Patient input also impacted further workup, with a patient's choice for a mastectomy over BCT negating the need for further imaging studies.

Of the 43.7% of patients who received an additional image-guided breast biopsy, new foci of cancer were identified in 33% of cases, leading to changes in care treatment plans (Table 2). Overall, 4.5% of the 153 patients we analyzed had additional cancer found during biopsy, which is similar to the 5.3% rate of additional cancer found during biopsy of breast cancer patients in the work by Newman et al. An additional 5 patients who had benign biopsy results also experienced management changes, including conversion to BCT (n=2) neo-adjuvant chemotherapy (n=1), contralateral wire localization (n=1) and ultrasound-guided fine needle aspiration of axilla (n=1). This suggests that additional imaging, independent of biopsy results, can alter care plans.

Ultimately 11.7% of our total patient population had changes in their breast cancer management as a result of our second opinion radiology program. These results parallel those reported by Newman et al., who found that 10.7% of their patients experienced a change in surgical management as a result of a similar program. The most frequent change in management identified in both our study and Newman's was to convert BCT to mastectomy.⁹ An accurate description of the extent of disease is paramount in patient selection for BCT, as multicentric or more extensive disease may preclude BCT and necessitate preoperative therapy or mastectomy.

Our study is subject to several limitations. Although we assume our changes in management resulted in improved patient outcomes, the study was observational and no control group existed. We cannot determine with certainty that the changes in care management can be directly correlated to an improvement in patient outcomes. Furthermore, we were not able to account for patient-related factors, such as anxiety over requiring further test results, which may have played a role in decision to alter management to more extensive resections (changing from BCT to mastectomy, for example). A larger study with a control arm would be required to definitively demonstrate benefits in terms of local/regional recurrence or reduction in the need for re-excisions from the additional radiologic review.

An area that warrants further research would be to study the cost-effectiveness or value of our second opinion breast radiology review program. While there is additional cost associated with performing additional imaging studies, there are potential cost savings if changes in care management circumvent the need for additional surgeries or treatments that a breast cancer patient would have undergone if the additional imaging studies had not been performed.

Finally, in prior work we identified additional imaging as a potential factor impacting timeliness to surgery.³ The relatively small sample of patients who underwent additional imaging in this study precluded our ability to determine the extent to which additional imaging led to any delay to surgery. Again, a larger study with controls and the ability to stratify by procedure could help to establish the impact additional imaging may have on timeliness of surgical management.

Despite these limitations, this study demonstrates that the additional imaging recommended by our breast radiology review program resulted in identification of new foci of cancer and in substantial changes in surgical management, suggesting clinical value was derived from this program.

CONCLUSION

A second opinion breast radiology review program was implemented to improve multidisciplinary care provided to patients referred to our cancer center. The aim of this study was to determine whether this program contributes significantly to changes in patient management. Our study demonstrates the impact this service has on the breast cancer treatment pathway, with 11.7% of patients experiencing a change in surgical management. These results suggest that the inclusion of a dedicated breast radiologist should be considered when designing comprehensive breast centers for optimal patient care. Additional larger studies with control arms should be considered to validate these preliminary findings.

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SYNOPSIS

Patients seeking second opinions for breast cancer therapy at comprehensive cancer centers are evaluated by multiple disciplines including radiology. Second opinion imaging consultation provides the opportunity to review outside studies and determine the need for additional radiologic evaluation that may alter local therapy decision-making.

Figure 1.
Flow diagram depicting the impact of second opinion imaging reviews on the management of breast cancer patients

Table 1

Additional Imaging Modality

Type of Additional Imaging	Number of Patients*
Mammography	28
Ultrasound	17
MRI	5

* Some patients had more than one imaging study performed

Table 2

Biopsy Results

Biopsy Results	Number of Patients
Contralateral Breast Benign	8
Same Breast Invasive	6
Same Breast Benign	4
Other	2
Same Breast DCIS	1
Total	21

Table 3

Changes in Management by Imaging/Biopsy Status

Change in Management	In patients requiring additional imaging only	In patients with biopsy performed (<i># new cancer on biopsy / # benign on biopsy</i>)	Total patients
Conversion to mastectomy	2	4 (4/0)	6
Additional Wire Placement	2	3 (3/0)	5
Conversion to BCT	1	3 (1/2)	4
Neoadjuvant therapy	0	1 (0/1)	1
Contralateral Wire Placement	0	1 (0/1)	1
US Guided FNA of Axilla	0	1 (0/1)	1
Total	5	13	18

Table 4
Comparison of Studies Examining the Changes in Recommended Management for Patients with Breast Lesions

Institution/Authors	Number of patients in study	Study population	% Patients undergoing biopsy	Biopsies resulting in identification of additional cancer. # of biopsies without results	% Patients with management changes due to imaging review (number of patients with changes/ total study population)
BWH-DFCI / Mallory et al.	153	Breast cancer	13.7% (21/153)	4.6% (7/153) *0	11.7%
Rush University / Spivey et al.	380	Benign and malignant breast disease	16.8% (64/380)	2.1% (8/380) *8	27.1%
University of Michigan/ Newman et al	149	Breast cancer	16.1% (24/149)	5.3% (8/149) *4	10.7% <i>a,b</i>
University of Pennsylvania/ Chang et al.	75	Benign and malignant breast disease	Not reported	Not reported	42.7% <i>a,c</i>

^aRecommended change only (actual change in management not evaluated)

^bWhile changes in management were assessed based on a range of other data, including clinical and pathology review, reported here is only the percentage of patients who had changes based on imaging review as determined by the original study

^cFrom clinical/radiology/ pathology review at multidisciplinary conference, as the individual contribution of radiology was not specified