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Extramammary findings in diagnostic breast magnetic resonance imaging among patients with known breast cancer: incidence and cost analysis



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Abstract

BACKGROUND: Extramammary findings (EMFs) are common on breast magnetic resonance imaging (MRI).

METHODS: A retrospective review of breast MRIs in breast cancer patients between January 2009 and December 2014 was performed to identify EMF occurrences, resultant evaluation, and added cost.

RESULTS: EMFs were noted in 185 (59%) of 316 MRIs. Overall, 201 new EMFs were identified with 178 (89%) benign and 23 (11%) malignant. New malignant findings included 19 metastatic nodes (18 axillary, 1 internal mammary) and 4 primary malignancies (2 thyroid, 2 lung). New malignant non-axillary EMFs occurred at a rate of 1.6% (5/316). EMFs resulted in 65 patients undergoing 98 imaging studies, 37 procedures, and 10 consultations with a median (range) total charge of \$3,491 (\$222 to \$29,076) and out of pocket cost of \$2,206 (\$44 to \$12,780) per patient.

CONCLUSIONS: EMFs occurred in more than half of our patients, were usually benign, and frequently led to additional testing and costs.

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Selective utilization of contrast-enhanced diagnostic breast magnetic resonance imaging (MRI) as an adjunct to physical examination and conventional imaging in patients diagnosed with breast cancer is considered for specific indications. These include clarification of extent of disease when limitations of conventional imaging are noted, identification of an occult primary in a patient with known axillary metastasis, evaluation of findings that remain

indeterminate following clinical examination and conventional imaging, and assessment of response to neoadjuvant therapy.¹⁻⁴ The American Society of Breast Surgeons advocates that the decision to include breast MRI in the evaluation of patients with breast cancer should represent a shared decision between the patient and physician after consideration of the benefits and risks.¹ It is true that MRI has been shown to image the breasts with a greater degree of sensitivity than mammography regardless of breast density.⁵ In patients with known breast malignancy, MRI has been shown to detect additional multifocal or multicentric disease in 6% to 34% of patients.⁶ A theoretical benefit of breast MRI in cancer patients is to clarify intramammary findings, such as tumor focality, centricity, and laterality, for the purpose of informing surgical planning to reduce re-excision rates, decrease ipsilateral and contralateral breast tumor recurrence, and improve long-term survival. However, in practice, routine preoperative MRI in breast cancer patients has been shown in the literature to be associated with larger volume excisions and increase rates of mastectomy without an overall improvement in re-excision rates, local recurrence, or long-term survival.⁷⁻⁹

In spite of this literature, utilization of breast MRI in patients diagnosed with breast cancer has been increasing. A study of the Surveillance, Epidemiology, and End Results registry from Washington State revealed advanced breast imaging with diagnostic MRI being performed at a rate of 27% between 2002 and 2009, reaching a rate of 46% in 2009, with a significantly higher proportion of MRIs being performed in younger women.¹⁰ This trend has additionally been validated by insurance claims data demonstrating 23% of breast cancer patients under the age of 65 undergoing breast MRI in 2005 compared with 53% by 2008.¹¹ In 2010, 41% of responders to a survey provided by the American Society of Breast Surgeons reported routine use of breast MRI in patients newly diagnosed with breast cancer.¹² Multiple recent randomized controlled trials, meta-analyses, reviews, and position statements have appraised the influence of diagnostic MRI on surgical and breast cancer outcomes.^{1-4,7-9} In contrast, the literature on extramammary findings (EMFs) is limited.

Although breast MRI focuses on a relatively small field of view that includes the mammary gland, overlying skin, underlying pectoralis muscle, and axilla, the images obtained also afford visualization of portions of the chest wall, lungs, mediastinum, neck, upper abdomen, and parts of the musculoskeletal system. Reported rates of identification of incidental EMFs noted on breast MRI range from 17% to 34% in large institutional series and may represent benign or malignant processes.¹³⁻¹⁷ Most studies reporting the incidence of such EMFs are not exclusive to patients with a known breast malignancy. In patients with breast cancer, the detection of these findings is considered imperative, as they may indicate systemic metastases, concurrent occult malignancies, or other benign lesions of clinical significance, any of which could alter management. Given the reported frequency of incidental EMFs in patients undergoing breast

MRI, consideration of the risks and benefits of breast MRI in patients with known cancer should also include a discussion of the implications of these findings, which are not well described. Therefore, we sought to further clarify the prevalence of extramammary MRI findings in patients diagnosed with breast cancer at our institution and to describe the clinical significance and added cost burden related to diagnostic evaluation of these additional findings.

Methods

We conducted an institutional review board-approved retrospective review of the electronic medical record of consecutive patients with breast cancer who received a diagnostic breast MRI at a community based multidisciplinary breast center. Patients with breast cancer who underwent MRI imaging between January 2009 and December 2014 were considered for inclusion. We excluded patients who received diagnostic evaluation and treatment outside of our health system, MRIs conducted for screening purposes, and repeat MRIs performed as interval follow-up of a recent study. Data collected included MRI indication as well as patient and tumor-specific characteristics such as patient age, tumor stage, and histology.

All breast MRIs were performed on site on a 3 Tesla Siemens Verio scanner (Erlangen, Germany) with the patient in the prone position in a bilateral dedicated 8 channel Sentinelle breast coil using a standard diagnostic protocol. Images were read by dedicated clinical breast radiologists with fellowship training. EMFs were defined as those identified outside the breast parenchyma, including axillary and mediastinal structures as well as the visualized portions of surrounding bony structures and viscera. Each EMF identified and subsequently included in the final imaging report was counted, and the location was noted. The medical record was then reviewed to determine whether this represented a new or previously known finding. A finding was considered new if it was not documented in the patient's history, including previous imaging reports. EMFs were characterized as benign or malignant based on documentation in the medical record. For purposes of this study, an EMF on MRI was determined to be malignant on retrospective review of the additional diagnostic evaluation, clinical documentation, or pathology.

Occurrences of additional consultations and diagnostic and therapeutic modalities based on MRI findings were recorded for each patient. Cost data was collected from a hospital billing query and is reported as the median (range) charge to the patient's insurance provider as well as the out of pocket cost to the patient after insurance adjustments and payments. Costs represent actual fees based on charges negotiated by the insurer according to each patient's unique health plan. Cost analysis was performed to estimate average cost of initial diagnostic evaluation and consultation per incidental finding and is reported as additional cost per additional evaluation, not per finding, as not all patients with EMFs required or underwent additional evaluation.

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