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Influence of preoperative magnetic resonance imaging on the surgical management of breast cancer patients

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Conservation treatment;
Surgical decision making

Abstract

BACKGROUND: Magnetic resonance imaging (MRI) is gaining popularity in the preoperative management of breast cancer patients. However, the role of this modality remains controversial. We aimed to study the impact of preoperative MRI (pMRI) on the surgical management of breast cancer patients.

METHODS: This retrospective study included 766 subjects with breast cancer treated operatively at the specialized academic center.

RESULTS: Between those who underwent pMRI (MRI group, n = 307) and those who did not (no-MRI group, n = 458), there were no significant differences ($P = .254$) in the proportions of either total mastectomies (20.5% vs 17.2%, respectively) or segmental mastectomies (79.5% vs 82.8%). Patients in the MRI group were significantly more likely ($P = .002$) to undergo contralateral surgery (11.7% vs 5.5%). Similar results were obtained in multivariate analysis adjusting for age, with the proportions of contralateral breast operations significantly higher in the MRI group (Odds Ratio = 2.25, $P = .007$). pMRI had no significant effect ($P = .54$) on the proportion of total re-excisions (7.5% vs 8.7%) or the type of re-excision (total vs segmental mastectomy) between the groups.

CONCLUSIONS: pMRI does not have a significant impact on the type of operative intervention on the ipsilateral breast but is associated with an increase in contralateral operations. Similarly, pMRI does not change the proportion of re-excisions or the type of the re-excision performed. This study demonstrates that pMRI has little impact on the surgical management of breast cancer, and its value

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as a routine adjunct in the preoperative work-up of recently diagnosed breast cancer patients needs to be re-examined.

Surgery is one of the mainstays of the management of breast cancer. The extent of surgery depends on a number of factors including an evaluation of the stage of disease clinically and radiologically. Although the roles of mammogram and ultrasound in the preoperative evaluation of disease extent are quite clearly defined, the role of the use of magnetic resonance imaging (MRI) in this setting is still under scrutiny.

The intent of using MRI, which is a very sensitive diagnostic tool,[1–3] is to increase detection of synchronous lesions otherwise undetectable by the clinical examination or other radiological investigations. Sensitivity for detection of index lesions by MRI is 93% to 98% compared with 83% to 86% for mammogram, 71% to 75% for ultrasound and 58% for clinical examination.[4–6] MRI also confers advantages in detecting multifocal or multicentric carcinoma,[4,7–9] estimating tumor extent[4] and detecting contralateral disease.[8,9] Overall, MRI leads to additional findings in up to 40% of women.[2,10–14] Thus MRI may potentially better assess the extent of disease in a selected group of patients. Hence, it has been suggested as a tool for preoperative surgical decision-making.[15,16]

However, the increased sensitivity conferred by MRI is overshadowed by increased costs and delays in time to surgery,[1,3,10,16–18] as well as its lack of specificity, which ranges from 65% to 84%.[1–3,5,7,10] Lack of specificity increases the risk of additional preoperative biopsies and/or more extensive operative interventions without added therapeutic benefits. Although some authors report that positive MRI findings generally prompt appropriate conversion from wide local excision to more extensive surgery, others do not find such association.[6,10,11,19–21]

Studies on the effect of preoperative MRI (pMRI) on surgical decision-making and it effects on clinical outcome are generally low-powered, controversial and not easily comparable because of the lack of uniformity in data collection.[10,16,18,20,22–25] It is also still debated whether use of pMRI leads to reduction in the rate of re-exicsions or confers survival benefits.[21,24,26–34]

The purpose of this study was to investigate effects of pMRI on changes in operative management and re-excision rates in a relatively large retrospective study in our specialized breast cancer center.

Methods

With the approval of the Institutional Review Board of the McGill University Health Centre, we conducted a retrospective review of patients who underwent surgical management for breast cancer at the McGill University Health Centre between January 1, 2006 and December 31, 2013.

We included patients who received definitive surgical treatment for biopsy-proven stage I to III breast cancer (invasive ductal, lobular, or mixed types). We excluded patients who received preoperative chemotherapy, had treatment for previous breast cancer, were diagnosed with in situ breast carcinoma or were younger than 30 years old. Furthermore, patients with a history of Hodgkin's lymphoma or BRCA-positive status were also excluded, as they comprise a high-risk population that is routinely screened by MRI. Patients were evaluated and treated by 1 of 6 surgeons at an academic institution.

Patients who met inclusion criteria (n = 765) were selected from our tumor registry and separated into 2 groups based on whether a pMRI was performed. The group of patients who did not undergo pMRI (no-MRI group) consisted of 458 subjects. The MRI group included 307 patients who had biopsy-proven invasive breast cancer at the time of MRI testing.

Magnetic resonance imaging

All bilateral breast MRIs were performed within our institution on a 1.5-T commercially available system (Signa Twin Speed Excite 1.5 T, GE Medical Systems, Milwaukee, WI, USA) using 8-channel breast phase array coil for signal reception. MRI consisted of axial no fat sat 3-dimensional T1-weighted VIBRANT-volume imaging breast assessment, axial 2-dimensional fast relaxation fast spin echo, fat sat gadolinium-enhanced images (3 phases) with subtraction in the axial plain, and 10 minutes delayed sagittal 2-dimensional VIBRANT. Breast MRI computer-aided detection software (Aegis 3.0–Sentinelle Medical Inc, Toronto, Ontario, Canada) was used to generate subtracted images, maximum intensity projection, kinetic color maps and graphs. They were interpreted by 4 experienced breast radiologists according to the Breast Imaging-Reporting and Data Systems protocol.

Clinicopathologic data

Furthermore, clinicopathologic information was collected from our electronic patient record database and the operative record database, as well as clinical chart review. These variables included: patient age, type of surgical intervention, year of surgery, tumor histologic type, tumor size, tumor grade, lymph node status, estrogen and progesterone receptor status, and HER-2 status. Re-excision was defined as an operative intervention on the same breast performed within 6 months from the first