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Preoperative Breast Magnetic Resonance Imaging Use by Breast Density and Family History of Breast Cancer

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Abstract

Background: Use of preoperative breast magnetic resonance imaging (MRI) among women with a new breast cancer has increased over the past decade. MRI use is more frequent in younger women and those with lobular carcinoma, but associations with breast density and family history of breast cancer are unknown.
Materials and Methods: Data for 3075 women ages >65 years with stage 0-III breast cancer who underwent breast conserving surgery or mastectomy from 2005 to 2010 in the Breast Cancer Surveillance Consortium were linked to administrative claims data to assess associations of preoperative MRI use with mammographic breast density and first-degree family history of breast cancer. Multivariable logistic regression estimated adjusted odds ratios (OR) and 95% confidence intervals (95% CI) for the association of MRI use with breast density and family history, adjusting for woman and tumor characteristics.
Results: Overall, preoperative MRI use was 16.4%. The proportion of women receiving breast MRI was similar by breast density (17.6% dense, 16.9% nondense) and family history (17.1% with family history, 16.5% without family history). After adjusting for potential confounders, we found no difference in preoperative MRI use by breast density (OR = 0.95 for dense vs. nondense, 95% CI: 0.73–1.22) or family history (OR = 0.99 for family history vs. none, 95% CI: 0.73–1.32).
Conclusions: Among women aged >65 years with breast cancer, having dense breasts or a first-degree relative with breast cancer was not associated with greater preoperative MRI use. This utilization is in keeping with lack of evidence that MRI has higher yield of malignancy in these subgroups.

Keywords: breast cancer, family history, breast density

Introduction

Preoperative breast magnetic resonance imaging (MRI) use among women with newly diagnosed breast cancer is increasing.[1–4] Current National Comprehensive Cancer Network (NCCN) guidelines state that breast MRI is optional for women newly diagnosed with breast cancer to determine the extent of disease, to screen the contralateral breast, and to inform treatment decisions.[5] However, preoperative breast MRI use has not been associated with improved outcomes and has been shown to be associated with increased anxiety, more biopsies, and higher mastectomy and contralateral prophylactic mastectomy rates.[6–9]

The NCCN guidelines specify that special consideration be given for MRI use in the setting of mammographically occult tumors. The NCCN provides no other patient or pathology factors to guide decisions regarding preoperative MRI. However, several studies have found preoperative MRI is used

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more frequently in women who are younger, married, have higher median income, fewer comorbidities, and lobular disease.[2,10,11] Few studies have evaluated the use of preoperative breast MRI by extent of breast density or first-degree family history of breast cancer. Since breast density affects radiologists' ability to visualize tumors on mammography, women with dense breasts may be more likely to receive and/or benefit from preoperative MRI compared to women with less dense breasts. However, several studies demonstrate no clear differences in additional cancer yield of MRI according to breast density.[12–16] Additionally, women diagnosed with breast cancer who have a family history of the disease have an increased risk of subsequent asynchronous contralateral breast cancer[17] and thus may also be more likely to undergo preoperative MRI in an attempt to detect such cancers earlier.

We utilized the Breast Cancer Surveillance Consortium (BCSC) population-based cohort of women with breast cancer to assess the relationship of Breast Imaging Reporting and Data System (BI-RADS) breast density and family history of breast cancer to preoperative MRI.

Materials and Methods

Data sources

We used data from five BCSC registries linked to administrative claims data from 2005 to 2010. BCSC breast imaging registries collect patient characteristics, risk factor data, and clinical information from radiology facilities at the time of breast imaging.[18] Breast cancer diagnoses were obtained by linking BCSC data to regional SEER programs, state tumor registries and pathology data sources. Data were pooled at a central Statistical Coordinating Center (SCC). All registries and the SCC received Institutional Review Board approval for active or passive consenting processes or a waiver of consent to enroll participants, link data, and perform analysis. All research procedures were Health Insurance Portability and Accountability Act (HIPAA) compliant, and BCSC breast imaging registries and the SCC received a Federal Certificate of Confidentiality and other protections for the identities of women, physicians, and imaging facilities.

BCSC data from 1998 to 2010 were linked to the Centers for Medicare and Medicaid Services' Medicare Program Master Enrollment file using unique Medicare identifiers such as name, date of birth, and social security number. The majority (86%) of BCSC women aged 65 and older from registries in this analysis were successfully linked to Medicare claims data. The most common reason for not being able to link was a lack of social security number. Claims data, including diagnostic and procedure codes for all health services obtained from Kaiser Permanente Washington Health, were available for women receiving a mammogram within the Kaiser Permanente Washington Health registry.

Study population

The study cohort included women with incident ductal carcinoma *in situ* (DCIS) or nonmetastatic invasive breast cancer diagnosed between January 2005 and June of 2010. We required women to be age 66 years or older at time of diagnosis as we have complete capture of MRI information for these women through linkage with claims data. We use the age of 66 rather than 65 years at time of diagnosis to allow for calculation of the comorbidity index in the year before diagnosis. For women enrolled in Medicare, we also required Parts A and B enrollment and no health maintenance organization (HMO) enrollment in the 12 months before and 6 months after breast cancer diagnosis. Similarly, for women enrolled in Kaiser Permanente Washington Health, we required 12 months of enrollment before and 6 months after the breast cancer diagnosis date. In addition, to be included, women had to receive either breast conserving surgery (BCS) or mastectomy as identified from claims codes (Appendix Table A1) within 6 months of their breast cancer diagnosis date.

Outcomes

We identified receipt of preoperative breast MRI from claims data using Current Procedural Terminology and Healthcare Common Procedure Coding System codes: 76093, 76094, 77058, 77059, C8903–C8908. The preoperative window was defined as the time between the breast cancer diagnosis date (measured as the biopsy date closest to the breast cancer diagnosis date) and receipt of BCS or mastectomy. We limited the preoperative window to a maximum of 6 months. For this analysis we compared the use of preoperative MRI versus no preoperative MRI.

Predictor variables

The main exposure variables of interest were mammographic breast density and first-degree family history of breast cancer. Mammographic breast density was provided by the radiologist interpretation on the most recent mammogram before the breast cancer diagnosis date using the BI-RADS breast density categories: almost entirely fatty, scattered areas of fibroglandular density, heterogeneously dense, and extremely dense. This mammogram had to occur within 5 years of diagnosis. We dichotomized the BI-RADS breast density as dense (extremely dense and heterogeneously dense) or nondense (scattered areas of fibroglandular density and almost entirely fatty). Women self-reported the presence of any female first-degree relative with a history of breast cancer at the time of the most recent mammogram.

Covariates

We adjusted for several self-reported patient factors, breast cancer risk factors, and tumor characteristics. Specifically, we adjusted for age at the time of breast cancer diagnosis, self-reported race (white, black, Asian, Hispanic, other), self-reported education (less than high school, high school graduate, some college, college graduate), prior benign breast biopsy (yes, no), and BCSC registry. We calculated and adjusted for the BCSC 5-year risk of developing breast cancer at the time of the most recent prior mammogram[19] as it is possible that clinicians may have used the risk score in their preoperative MRI decision-making process. We also calculated and adjusted for comorbidity in the 1-year period before diagnosis using the Klabunde adaptation of the Charlson comorbidity index.[20] We also adjusted for the year of breast cancer diagnosis and tumor characteristics including cancer type (DCIS or invasive), invasive histology (ductal, lobular, lobular and ductal, other), grade (low, intermediate, high), stage (0, I, II, III), tumor size (<1, 1 to <2, 2 to <5, 5+ cm), progesterone receptor (PR) status (positive, negative), and

estrogen receptor (ER) status (positive, negative). The tumor characteristics are those reported to the regional or state cancer registries at each of the BCSC sites and could come from the diagnostic biopsy or from the breast surgery.

Statistical analysis

The proportion of women receiving preoperative MRI by patient and tumor characteristics was calculated. Multivariable logistic regression estimated adjusted odds ratios (OR) and 95% confidence intervals (95% CI) for the association of MRI use with breast density and family history, adjusting for patient age, race, education, comorbidities, year of diagnosis, grade, size, ER status, PR status, 5-year BCSC risk score, cancer type, and, among invasive cancers, histology and stage. This model includes interaction terms between histology and invasive cancer, allowing for estimation of ORs for histology among women with invasive cancer only. To account for missing covariate information we employed multiple imputation using the method of multiple imputation via chained equations.[21] We used the *IVEware* in SAS 9.3 with the module ''IMPUTE'' to create five complete data sets with missing values imputed. Logistic regression models were fit to each imputed data set and estimates were combined across imputations using standard rules for multiple imputation.[22] We do not report an overall cancer type effect because invasive cancers were further stratified by histology and stage.

To evaluate the impact of year of diagnosis on the association between preoperative MRI use and density or family history, we conducted a sensitivity analysis in which we stratified the data into two time periods: 2005–2008 and 2009–2010. We chose these time periods as they coincide with increased awareness of breast density as a risk factor for breast cancer with the passage of breast density notification laws beginning in 2009.

Results

Overall, preoperative MRI use was 16.4% in the 3075 women in our study population. Women receiving preoperative MRI tended to be younger, were more likely to be white, had higher educational attainment, and had fewer comorbid conditions. Use of preoperative MRI increased over time (Table 1). Among women with a preoperative MRI, 24.3% reported a first-degree family history of breast cancer versus 23.1% of women with no preoperative MRI. Approximately 36% of women with a preoperative MRI had dense breasts versus 33% of those without a preoperative MRI.

In terms of tumor characteristics, among women with a preoperative MRI, 25.8% had a lobular component (15.1% with lobular and 10.7% with lobular and ductal) compared with 12.5% (6.9% with lobular and 5.6% with lobular and ductal) among those with no MRI (Table 2). Approximately 9.1% of women undergoing a preoperative MRI had stage III disease versus 6.5% of women without an MRI. The distribution of tumor grade and size was similar among women with and without MRI.

In the multivariable logistic regression model, receipt of preoperative breast MRI did not differ for women with dense compared with nondense breasts (OR = 0.95, 95% CI: 0.73–1.22) or for those with a first-degree family history of breast cancer compared with those without (OR = 0.99, 95% CI: 0.73–1.32) (Table 3). Older women were less likely to receive preoperative MRI as were those with a comorbidity score of three or more. Year of breast cancer diagnosis was significantly positively associated with receiving preoperative MRI, with women diagnosed in 2009 being over four times more likely to have a preoperative MRI than women diagnosed in 2005. In terms of ER and PR status, women with

Table 1. Characteristics of the Cohort by Preoperative Magnetic Resonance Imaging Use, from the Breast Cancer Surveillance Consortium Linked to Administrative Claims Data, 2005–2010

Characteristic	*No MRI* N = *2572* N *(%)*	*MRI* N = *503* N *(%)*
Age		
66–69	612 (23.8)	159 (31.6)
70–74	651 (25.3)	172 (34.2)
75–79	595 (23.1)	100 (19.9)
80–84	430 (16.7)	61 (12.1)
85+	284 (11.0)	11 (2.2)
Race		
White	2105 (81.8)	430 (85.5)
Black	125 (4.9)	13 (2.6)
Hispanic	31 (1.2)	[b]
Asian	54 (2.1)	[b]
Other	23 (0.9)	[b]
Missing	234 (9.1)	38 (7.6)
Educational level		
<High school graduate	207 (8.0)	20 (4.0)
High school graduate	722 (28.1)	117 (23.3)
>High school graduate	1277 (49.7)	281 (55.9)
Unknown	366 (14.2)	85 (16.9)
Comorbidity index		
0	1669 (64.9)	359 (71.4)
1	581 (22.6)	104 (20.7)
2	202 (7.9)	29 (5.8)
3+	120 (4.7)	11 (2.2)
Year of diagnosis		
2005	598 (23.3)	53 (10.5)
2006	549 (21.3)	72 (14.3)
2007	461 (17.9)	95 (18.9)
2008	431 (16.8)	117 (23.3)
2009	358 (13.9)	118 (23.5)
2010[a]	175 (6.8)	48 (9.5)
First-degree family history of breast cancer		
Yes	593 (23.1)	122 (24.3)
No	1889 (73.4)	[c]
Unknown	90 (3.5)	[b]
BI-RADS breast density		
Nondense (almost entirely fatty or scattered fibroglandular densities)	1138 (44.2)	231 (45.9)
Dense (heterogeneously dense or extremely dense)	855 (33.2)	183 (36.4)
Unknown	579 (22.5)	89 (17.7)

[a]Data from 2010 included only a portion of the year; [b]indicates cell sizes <11; [c]cell value hidden so that cell sizes <11 cannot be calculated in accordance with the Medicare Data Use Agreement.

BI-RADS, Breast Imaging Reporting and Data System; MRI, magnetic resonance imaging.

Table 2. Tumor Characteristics by Preoperative Magnetic Resonance Imaging Use, from the Breast Cancer Surveillance Consortium Linked to Administrative Claims Data, 2005–2010

Characteristic	*No MRI* N = *2572* N *(%)*	*MRI* N = *503* N *(%)*
Histology		
Ductal carcinoma *in situ*	486 (18.9)	77 (15.3)
Invasive, ductal	1611 (62.6)	270 (53.7)
Invasive, lobular	178 (6.9)	76 (15.1)
Invasive, lobular and ductal	143 (5.6)	54 (10.7)
Invasive, other	103 (4.0)	$
Missing	51 (1.9)	**
Stage		
0	486 (18.9)	77 (15.3)
I	1264 (49.1)	241 (47.9)
II	656 (25.5)	139 (27.6)
III	166 (6.5)	46 (9.1)
Grade		
Low	538 (20.9)	102 (20.3)
Intermediate	1106 (43.0)	233 (46.3)
High	755 (29.4)	128 (25.4)
Unknown	173 (6.7)	40 (8.0)
Tumor size		
<1 cm	691 (26.9)	126 (25.0)
1 to <2 cm	1000 (38.9)	189 (37.6)
2 to <5 cm	659 (25.6)	145 (28.8)
5+ cm	119 (4.6)	30 (6.0)
Unknown	103 (4.0)	13 (2.6)
Estrogen receptor status		
Positive	1919 (74.6)	421 (83.7)
Negative	399 (15.5)	68 (13.5)
Unknown	254 (9.9)	14 (2.8)
Progesterone receptor status		
Positive	1655 (64.3)	335 (66.6)
Negative	623 (24.2)	145 (28.8)
Unknown	294 (11.4)	23 (4.6)
BCSC 5-year risk before breast cancer diagnosis		
0 to 1.66	177 (6.9)	27 (5.4)
>1.66 to 2.49	707 (27.5)	160 (31.8)
>2.49 to 3.99	534 (20.8)	119 (23.7)
>3.99	340 (13.2)	93 (18.5)
Unknown	814 (31.6)	104 (20.7)

** = indicates cell sizes <11; $ = cell value hidden so that cell sizes <11 cannot be calculated in accordance with the Medicare Data Use Agreement.

BCSC, Breast Cancer Surveillance Consortium.

ER positive tumors were more likely to have preoperative MRI while women with PR positive tumors were less likely to have preoperative MRI performed. Among women with invasive breast cancer, women with a lobular histology were 2.6 to 2.9 times more likely to have a preoperative MRI compared with women with ductal histology. We included interaction term of breast density and cancer stage since women with dense breasts may have higher stage at diagnosis if their increased density masked lesions. Hence, we may expect women with dense breasts to obtain more MRI to find additional disease that would up stage them than if they have low density. We also include an interaction of breast density and histology since prior studies have shown preoperative

Table 3. Predictors of Magnetic Resonance Imaging Use Among Women Ages 66 and Older with Ductal Carcinoma *In Situ* or Invasive Stage I–III Breast Cancer, from the Breast Cancer Surveillance Consortium Linked to Administrative Claims Data, 2005–2010

Characteristic	*Category*	*All cancers adjusted OR[a] (95% CI)*
Age	66–69	Referent
	70–74	1.01 (0.78–1.30)
	75–79	0.62 (0.46–0.83)
	80–84	0.54 (0.38–0.75)
	85+	0.14 (0.07–0.27)
Race	White	Referent
	Black	0.68 (0.34–1.38)
	Other	0.98 (0.62–1.55)
Family history of breast cancer	Yes	0.99 (0.73–1.32)
	No	Referent
Breast density	Nondense	Referent
	Dense	0.95 (0.73–1.22)
Education	<High school	Referent
	High school grad	1.13 (0.62–2.08)
	Some college	1.27 (0.70–2.32)
	College grad	1.52 (0.84–2.74)
Comorbidity index	0	Referent
	1	0.86 (0.66–1.11)
	2	0.79 (0.51–1.23)
	3+	0.49 (0.25–0.93)
Year of diagnosis	2005	Referent
	2006	1.50 (1.02–2.22)
	2007	2.51 (1.72–3.65)
	2008	3.39 (2.34–4.92)
	2009	4.25 (2.92–6.17)
	2010	3.48 (2.21–5.48)
Histology	Invasive, ductal	Referent
	Invasive, lobular	2.90 (1.64–4.16)
	Invasive, lobular and ductal	2.63 (1.44–3.82)
	Invasive, other	1.35 (0.53–2.18)
Grade	Low	Referent
	Intermediate	1.07 (0.80–1.43)
	High	1.00 (0.70–1.44)
Stage	0	NA
	I	Referent
	II	1.30 (0.82–1.78)
	III	1.53 (0.78–2.27)
Size	<1 cm	Referent
	1 to <2 cm	1.06 (0.81–1.39)
	2 to <5 cm	1.26 (0.87–1.82)
	5+ cm	1.25 (0.71–2.20)
Estrogen receptor status	Positive	1.62 (1.07–2.43)
	Negative	Referent
Progesterone receptor status	Positive	0.64 (0.48–0.87)
	Negative	Referent
BCSC 5-year risk score	0 to 1	Referent
	>1 to 1.66	1.40 (0.34–5.88)
	>1.66 to 2.49	1.58 (0.58–4.27)
	>2.49 to 3.99	1.52 (0.53–4.38)
	>3.99	1.82 (0.74–4.47)

NA = not applicable as these were interaction term in model with cancer type.

[a]Adjusted model includes all variables in the table in the model.

CI, confidence intervals; OR, odds ratios.

MRI to be used more frequently in women with invasive lobular carcinoma. Mammographic sensitivity is decreased for women with heterogeneous or extremely dense breast tissue and also for women with invasive lobular carcinoma. We hypothesized that women with dense breasts who were diagnosed with invasive lobular carcinoma may be more likely to receive preoperative MRI given the atypical and subtle patterns of invasive lobular carcinoma that may be further masked by dense breast tissue. Neither interaction term was significant.

The logistic regression results from the sensitivity analysis stratifying the data into 2005–2008 and 2009–2010 found no association between breast density or family history of breast cancer and use of preoperative MRI in either time period. Compared to women with nondense breasts, women with dense breasts in 2005–2008 had an OR of 0.93 (95% CI: 0.69–1.27) versus in 2009–2010 the OR was 0.97 (95% CI: 0.60–1.56). Women with a first degree female family history of breast cancer had an OR of 0.96 (95% CI: 0.67–1.37) in 2005–2008 versus an OR of 1.06 (95% CI: 0.62–1.81) in 2009–2010.

Discussion

We found no association between preoperative MRI use and either first-degree family history of breast cancer or higher breast density among women ages 66 and older with stage 0-III breast cancer. These findings have clinical and research implications. First, our finding that women are not receiving preoperative breast MRI based on their breast density is surprising since some have advocated for MRI use in particular in women with dense breasts.[23] Hence, we expected to find that women with dense breasts would have more frequent use of preoperative breast MRI. It may be that clinical practices adopt a standard for MRI use that is universally applied to all patients newly diagnosed with breast cancer regardless of patient characteristics. Second, our result that women with a first-degree relative with breast cancer are not more likely to have MRI is unanticipated as prior studies suggest an increased risk of contralateral breast cancer in women with a family history of breast cancer and no *BRCA1* or *BRCA2* mutations.[17,24] Finally, our findings that younger women, those with fewer comorbidities, and those with lobular histology were more likely to receive preoperative breast MRI are similar to previous studies.[2–4,10,25,26] These factors are stronger predictors of preoperative MRI use than breast density and first-degree family history of breast cancer.

A single prior study examined the use of preoperative breast MRI by breast density among 1919 women ages 18 and older enrolled in Group Health Cooperative (now called Kaiser Permanente Washington Health) with incident breast cancer from 2002–2009. A portion of this population (women ages 66 and older from Group Health Cooperative) overlaps with our study population. The prior study by Loggers et al. found that women with nondense breasts were 48% less likely to have MRI compared with women with dense breasts.[27] This finding is in contrast to our result of no association and may be due to differences in the study population ages (we included 66 and older whereas Loggers et al. included 18 and older), geographic areas, adoption of clinical standards, and healthcare system types (we included all women in BCSC registries and Loggers et al. included one HMO in the northwestern United States), or covariates adjusted for in the models. In another study, 1012 breast surgeons in the United States were surveyed in December 2010 and asked if they routinely recommended breast MRI to women newly diagnosed with breast cancer (routinely was defined as ≥75% of the time). Approximately 41% of respondents reported routinely recommending MRI but this was higher for certain subgroups of women. Most surgeon respondents reported recommending routine MRI use for those with extremely dense breast density (87.9% of surgeons), women with a strong family history of breast cancer (73.4% of surgeons), or those with a diagnosis of invasive lobular carcinoma (69.4% of surgeons).[28]

Among women with a family history of breast cancer study results on preoperative MRI utilization are inconclusive. In a study of 149 women with DCIS, there was no difference in receipt of preoperative MRI by family history (first, second, or third degree relative, $p = 0.52$).[29] Although there is some suggestion that physicians recommend preoperative breast MRI to women with a family history, as noted in the survey of U.S. breast surgeons,[28] evidence of increased use in clinical settings is lacking. For example, Saunders and Taylor note that the use of MRI for follow-up after breast cancer is unclear but that it seems reasonable to use MRI in women with a strong family history or a genetic mutation.[30]

Studies of preoperative breast MRI have not clearly demonstrated higher additional cancer yields in women with dense breasts.[31,32] Bernard et al. examined the prevalence of pathologically confirmed contralateral breast cancer diagnosed solely by MRI focusing on age, breast density, family history, menopausal status, and primary-tumor characteristics. Postmenopausal status was the only significant predictor of contralateral cancer detected by MRI ($p = 0.016$) and neither breast density nor family history were significant predictors of contralateral breast cancer detected on MRI.[31] A study of 1038 Korean women with breast cancer also found that breast density was not associated with detection of additional malignancy on MRI.[32]

While our study is the largest to examine the use of preoperative breast MRI by extent of breast density and first-degree family history of breast cancer, we recognize several limitations. Since we primarily used Medicare claims data to identify use of preoperative MRI, our study population was limited to women ages 66 and older who typically have less dense breast tissue than younger women and thus our results may not be generalizable to younger women. We were able to include women from diverse geographic areas and were able to incorporate woman, clinical, and tumor factors into our study by linking the BCSC data with claims data. However, we were unable to assess genetic mutations as this information is not available in either data source. Due to the sample size we categorized breast density into nondense and dense, which could have masked an effect of individual density categories. Future work should examine breast density in four distinct categories. While the odds ratios for family history and breast density were nonsignificant, we are unable to rule out the possibility of effects as large as 1.3 or 1.2, respectively, given the 95% CI. In addition, the data for this study only go through 2010. In the last 7 years there has been increasing awareness of breast density, and it is possible that practice patterns may have changed during this time.

In conclusion, we found that neither breast density nor having a first-degree female relative with breast cancer are

predictors of receiving preoperative MRI among older women but that use of preoperative MRI increased from 2005 to 2010. Of note, this nondifferential utilization pattern is in line with the lack of evidence that MRI has higher yield of malignancy in these subgroups. We also found that in older women several patient and tumor characteristics, such as younger age, lower comorbidity score, more recent diagnosis date, and lobular histology are associated with preoperative MRI use even after adjusting for other characteristics. Additional studies should examine which woman and tumor characteristics may be used in clinical decision making for preoperative breast MRI.

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Author Disclosure Statement

No competing financial interests exist.

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Appendix

Appendix Table A1. ICD-9-CM, CPT, HCPCS, and DRG Codes Used to Identify Breast Conserving Surgery, Mastectomy, and Magnetic Resonance Imaging

	ICD-9-CM code	*CPT or HCPCS code*	*DRG code*
Breast conserving surgery	85.22, 85.23	19120, 19160, 19162, 19301, 19302	n/a
Mastectomy	85.33, 85.34, 85.35, 85.36, 85.4, 85.41.85.42, 85.43, 85.44, 85.45, 85.46, 85.47, 85.48, V51.0	19180, 19182, 19200–19220, 19240, 19303, 19304, 19305, 19306, 19307	257, 258, 259, 260
Breast magnetic resonance imaging	n/a	76093, 76094, 77058, 77059, C8903, C8904, C8905, C8906, C8907, C8908	n/a

CPT, Current Procedural Terminology; DRG, Diagnosis Related Group; HCPCS, Healthcare Common Procedure Coding System; ICD-9-CM, International Classification of Disease, 9th revision, Clinical Modification.