

RC315

### Breast Series: MRI

Tuesday, Nov. 27 8:30AM - 12:00PM Room: Arie Crown Theater

**BR** **MR**

AMA PRA Category 1 Credits™: 3.50  
ARRT Category A+ Credits: 4.00

**FDA** Discussions may include off-label uses.

#### Participants

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#### Sub-Events

##### RC315-01 Outcome Data: Does MRI Help?

Tuesday, Nov. 27 8:30AM - 8:50AM Room: Arie Crown Theater

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#### LEARNING OBJECTIVES

1) Know the current debate about the need of outcome data for an appropriate use of breast MRI in clinical practice. 2) Understand why the acceptance of breast MRI has a large variability by other clinicians depending on indication, from screening of BRCA1/2 or P53 mutated women to the preoperative setting. 3) Appraise the high complexity of the current debate on the evidence in favor or against preoperative breast MRI. 4) Identify those applications where more research is needed for an increased use of breast MRI, also considering the perspective of prognostic breast MRI.

##### RC315-02 Comparison of Diagnostic Performance of DBT and MRI Added to Mammography for Preoperative Staging of Screening-Detected Breast Cancer: Which Method Is More Appropriate Depending On the Mammographic Density?

Tuesday, Nov. 27 8:50AM - 9:00AM Room: Arie Crown Theater

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#### PURPOSE

To compare the diagnostic performance of digital breast tomosynthesis (DBT) and magnetic resonance imaging (MRI) added to mammography for preoperative staging of screening-detected breast cancer depending on mammographic density.

#### METHOD AND MATERIALS

This retrospective study enrolled 281 patients with 332 screening-detected breast cancers recruited from Jan to Dec 2013. Three radiologists independently reviewed three image sets of (mammography alone, DBT plus mammography and MRI plus mammography) of the patients, and they recorded final BI-RADS categories of detected lesions. BI-RADS categories 4-5 defined positive results and BI-RADS category 1-3 defined negative results. Readers' sensitivities and positive predictive values (PPVs) were analyzed for each reading mode. Readers' performances with the three reading modes were compared for dense breast (heterogeneously or extremely

dense, n=263) and non-dense breast (entirely fatty or scattered areas of fibroglandular density, n=120) groups, respectively.

## RESULTS

In non-dense breast group, readers' sensitivities with DBT plus mammography (92.5-94.4%) were lower than MRI plus mammography (96.3-98.1%), but higher than mammography alone (88.8-92.5%). Readers' PPVs with DBT plus mammography (97.1-100%) were higher than those with MRI plus mammography (94.7-100%) and mammography alone (94.7-97.0%). However, there was no statistically significant difference in both readers' sensitivities and PPVs between DBT plus mammography and MRI plus mammography ( $p>0.05$ ). In dense breast group, sensitivities with MRI plus mammography (93.3-98.2%) were significantly higher than those with DBT plus mammography (87.6-92.0%) or mammography alone (84.9-87.6%) ( $p<0.05$ ), but PPVs with MRI plus mammography (92.1-97.5%) were lower than those with DBT plus mammography (96.1-97.6%) or mammography alone (96.1-97.5%) without a statistical significance.

## CONCLUSION

In non-dense breast group, diagnostic performances of DBT and MRI for preoperative staging of screening-detected breast cancer were not significantly different when using as an adjunctive to mammography. In dense breast group, however, DBT had lower sensitivity than MRI.

## CLINICAL RELEVANCE/APPLICATION

In non-dense breast group, DBT plus mammography may provide similar diagnostic performance to MRI plus mammography for preoperative staging of screening-detected breast cancer.

### RC315-03 Pre-Chemotherapy Morphology and ADC Characteristics of Primary Breast Cancers Vary By Hormone-Receptor and HER2 Subtype

Tuesday, Nov. 27 9:00AM - 9:10AM Room: Arie Crown Theater

#### Participants

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#### PURPOSE

To evaluate the hormone-receptor (HR) and HER2 subtype dependence of pre-treatment MRI morphology and apparent diffusion coefficient (ADC) characteristics of primary breast cancers.

#### METHOD AND MATERIALS

A retrospective analysis of DCE-MRI, DW-MRI and T2WI was performed on pre-treatment MRI studies of 220 breast cancer patients who were enrolled in a neoadjuvant breast cancer trial. DCE-MRI and T2WI were reviewed according to the BI-RADS lexicon, and MRI morphologic pattern was categorized using a 1-5 scale for tumor containment. Extent of necrosis and presence of peritumoral edema were also ranked. ADC values at 5, 15, 25, 50, 75 and 95 percentile were computed from the DW-MRI based on an ROI encompassing the entire tumor volume. Fisher's exact test was used to compare the morphologic features and one-way ANOVA and Scheffe post hoc test were used to compare ADC measurements among all breast cancer subtypes.

#### RESULTS

The triple negative (TN) subtype exhibited mass more frequently than non-mass enhancement (NME) ( $p=0.004$ ), with masses showing irregular versus spiculated margin ( $p=0.034$ ). HR-/HER2+ subtype had NME more frequently than mass ( $p=0.027$ ). HR+/HER2+ showed heterogeneous enhancement rather than rim enhancement ( $p<0.001$ ). There was no specific pattern observed in NME among subtypes. In the MRI morphologic pattern, TN showed a well-defined pattern with more than 10% necrosis versus other subtypes. The difference in ADC values at the lower 5 and 15 percentiles was found to be statistically significant between TN vs. HR-/HER2+ ( $p=0.007$  in 5 percentile and  $p=0.014$  in 15 percentile), HR-/HER2+ vs. HR+/HER2- ( $p=0.002$  in 5 percentile and  $p=0.004$  in 15 percentile), and HR+/HER2- vs. HR+/HER2+ ( $p=0.028$  in 5 percentile and  $p=0.014$  in 15 percentile).

#### CONCLUSION

The BI-RADS lexicon (lesion classification, internal enhancement pattern and margin of the mass), MR morphologic pattern, and the amount of necrosis may be useful for distinguishing breast cancer subtypes. Among the variable measurements, the lower 5 or 15 percentiles of the ADC distributions showed potential to distinguish breast cancer subtypes.

#### CLINICAL RELEVANCE/APPLICATION

Adding the lower 5 or 15 percentile ADC with MR morphologic patterns may help refine MRI methods for distinguishing breast cancer subtypes prior to neoadjuvant chemotherapy.

### RC315-04 Pre-Operative Breast Magnetic Resonance Imaging: Relationship Between Magnetic Resonance-Detected Additional Cancer and Survival Outcomes

Tuesday, Nov. 27 9:10AM - 9:20AM Room: Arie Crown Theater

#### Participants

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#### PURPOSE

To determine the additional cancer detection yield of pre-operative MRI in women with invasive breast cancer that was occult on

mammography and ultrasonography (US), to identify a subgroup of women who are likely to have additional cancer, and to investigate whether the presence of MRI-detected additional cancer (MDAC) affects patients' long-term survival outcomes.

#### **METHOD AND MATERIALS**

The pre-operative MRI examinations of 1,843 women who had undergone surgery for invasive breast cancer were reviewed for the presence of additional multifocal/multicentric /contralateral disease that was occult on mammography and US. Clinicopathological findings and mammographic breast density were compared between patients with MDAC and those without. Logistic regression analysis was conducted to find factors associated with MDACs. A Cox proportional hazards model was used to analyze the effects of MDACs or other variables on disease-free survival (DFS) or overall survival (OS). Kaplan-Meier curves and log-rank tests were used to analyze survival between the two groups.

#### **RESULTS**

Of 1,843 patients, 178 (9.7%) had an MDAC. Multivariate analysis showed that invasive lobular cancer (odds ratio: 1.151, 95% confidence interval [CI]: 1.080, 1.239;  $P = 0.0002$ ) and extensive intraductal component (odds ratio: 1.113, 95% CI: 1.080, 1.148;  $P < 0.0001$ ) were independently associated with a higher probability of MDAC. Kaplan-Meier curves did not show that MDACs affected DFS ( $P = 0.343$ ) or OS ( $P = 0.991$ ).

#### **CONCLUSION**

MDACs had no significant impact on survival outcomes.

#### **CLINICAL RELEVANCE/APPLICATION**

No studies have focused on survival outcomes in MRI-detected additional cancers (MDACs) that were occult at mammography and ultrasonography (US).

### **RC315-06 Long-Term Survival Outcomes in Invasive Lobular Carcinoma Patients with and Without Preoperative MR Imaging: A Matched Cohort Study**

Tuesday, Nov. 27 9:30AM - 9:40AM Room: Arie Crown Theater

#### **Participants**

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#### **PURPOSE**

To investigate and compare the effect of preoperative breast magnetic resonance (MR) imaging on recurrence-free survival (RFS) and overall survival (OS) outcomes among patients with invasive lobular carcinoma (ILC).

#### **METHOD AND MATERIALS**

A total of 287 ILC patients (age range, 31-82 years; mean age, 49.8 years) between January 2005 and December 2012 were included in the analysis. Of these patients, 120 (41.8%) had undergone preoperative breast MR imaging (MR group) and the remaining 167 (58.2%) had not (no MR group). These two study groups were matched for 21 covariates in term of patient demographics, tumor characteristics, and various clinical features. The RFS and OS outcomes were compared using Kaplan-Meier estimates. MR effects were estimated after adjusting for significant potential confounders of specific outcomes in the multivariate modeling.

#### **RESULTS**

In the matched cohort, no statistically significant association was observed between MR imaging and total recurrence (hazard ratio [HR], 1.096; 95% CI: 0.497-2.416;  $P=0.821$ ), loco-regional recurrence (HR, 1.204; 95% CI: 0.294-4.924;  $P=0.796$ ), contralateral breast recurrence (HR, 0.945; 95% CI: 0.147-6.061;  $P=0.952$ ), or distant recurrence (HR, 1.020; 95% CI: 0.339-3.070;  $P=0.973$ ). MR imaging was associated with an improved OS with 51% reduction, but not significantly (HR, 0.485; 95% CI: 0.149-1.585;  $P=0.231$ ). Analysis with a multivariate Cox regression model indicated that MR imaging was not a significant independent factor for better RFS (HR, 0.823; 95% CI: 0.409-1.658;  $P=0.586$ ) or improved OS (HR, 0.478; 95% CI: 0.167-1.366;  $P=0.168$ ).

#### **CONCLUSION**

Preoperative MR imaging is not a prognostic factor and produces no recurrence or survival outcome benefits in ILC patients.

### **RC315-07 Preoperative Breast MRI: Multicenter Prospective Study**

Tuesday, Nov. 27 9:40AM - 9:50AM Room: Arie Crown Theater

#### **Participants**

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## PURPOSE

To investigate the effect of breast MRI for preoperative staging on clinical evaluation and treatment plan in women diagnosed with breast cancer.

## METHOD AND MATERIALS

In the prospective, multicenter study, the institutional ethics committee approval was obtained for all centers. Conventional imaging (mammography and ultrasonography) findings, preoperative breast MRI findings, treatment plan and histopathology results were evaluated in 432 consecutive breast cancer patients at nine centers. Cases that were scheduled to receive neoadjuvant chemotherapy were excluded. The effect of preoperative breast MRI added to conventional breast imaging on clinical-radiological evaluation and on surgical treatment plan was investigated. Chi-square and McNemar tests were used for statistical analysis.

## RESULTS

Two-hundred thirty-four cases (54.2%) were premenopausal and 198 cases (45.8%) were postmenopausal. Cancer was detected in 134 women (31%) at the time of screening, and cancer was found in 298 (69%) women who had undergone diagnostic radiological evaluation due to complaints or physical examination. Physical examination was positive in 248 (57%) women and negative in 184 (43%) women. 23 women had bilateral breast cancer. The frequencies of multifocal and multicentric tumor detection were 9-7%, 16-11%, 17-28% for MG, US and MRI, respectively. Breast-conserving surgery (BCS) was performed on a total of 210 cancers and modified radical mastectomy (MRM) on 255 cancers. A total of 8 cases required re-excision surgery due to positive surgical margin. MRI changed the surgical treatment plan in 14% of patients for whom BCS was planned based on conventional imaging. The difference between the conventional imaging and MRI in the preoperative evaluation was considered statistically significant ( $p=0.001$ ).

## CONCLUSION

Breast MRI added to conventional breast imaging in the preoperative evaluation of patients with breast cancer contributes to an accurate treatment plan by lower need for re-excision surgery and providing accurate treatment of the 14% cases.

## CLINICAL RELEVANCE/APPLICATION

This study showed that breast MRI contributes to the preoperative evaluation and treatment plan in women who were diagnosed with breast cancer.

### RC315-08 Ongoing Trials Update

Tuesday, Nov. 27 9:50AM - 10:10AM Room: Arie Crown Theater

#### Participants

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## LEARNING OBJECTIVES

To list the current studies published on the use of MRI for screening To list cancer detection rates and predictive values of abbreviated MRI for screening in comparison to those of digital breast tomosynthesis and breast ultrasound.

### RC315-09 Breast MRI-based Radiomics Nomogram for the Prediction of Recurrence in Patients with Triple-negative Breast Cancer: A Nested Case-Control Matched Study

Tuesday, Nov. 27 10:10AM - 10:20AM Room: Arie Crown Theater

#### Participants

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## PURPOSE

To develop a breast MRI-based radiomics nomogram including clinicopathologic factors for individualized prediction of local or distant recurrences in patients with triple-negative breast cancers (TNBC).

## METHOD AND MATERIALS

From 2006 to 2013, a total of 2604 patients were diagnosed as TNBC and 836 patients underwent preoperative breast MRI. Among them, patients with recurrence and without recurrence were matched in terms of age, stage, and type of chemotherapy, and developed 115 nested case-control pairs. Within the intratumor and peritumoral regions on early post-contrast T1-weighted images, percent enhancement (PE) map, signal enhancement ratio (SER) map, and T2-weighted images, a total of 1029 quantitative MR radiomic features, each referred to as a computer-extracted image phenotypes (CEIP), were calculated based on the semiautomatically derived three-dimensional tumor segmentations. Elastic Net was used for feature selection and radiomics score building. A radiomics nomogram was constructed from a multivariable logistic regression prediction model with the radiomics score and independent pathologic predictors. We divided 115 case-control pairs into a training set ( $n=154$ ) and a validation set ( $n=76$ ), and the internal validation for the validation set was performed.

## RESULTS

The radiomics score, consisted of 20 selected CEIPs, was significantly associated with the prediction of recurrence (C-index of 0.867 for training set and 0.778 for validation set). Independent pathologic factors in the nomogram were lymphovascular invasion, Ki-67 status, and lymph node ratio (C-index of 0.665 for training set and 0.668 for validation set). Radiomics nomogram showed better prediction of recurrence (C-index of 0.879 for training set and 0.802 for validation set) due to incremental value of 0.214 and 0.134, respectively, by addition of radiomics score to the pathologic predictors.

## CONCLUSION

Our results indicate that the radiomics nomogram which incorporates the MRI-based radiomics score and pathologic features, show promise for the individualized prediction of local or distant recurrence in patients with TNBC.

## CLINICAL RELEVANCE/APPLICATION

Nomogram using breast MRI-based radiomics score and pathologic predictors can facilitate the individualized prediction of recurrence in patients with TNBC.

### RC315-11 Advanced Sequences

Tuesday, Nov. 27 10:40AM - 11:00AM Room: Arie Crown Theater

#### Participants

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## LEARNING OBJECTIVES

1) Review the standard dynamic contrast-enhanced MRI (DCE-MRI) and quantitative MRI using two compartment model. 2) Understand the current status of abbreviated breast MRI. 3) Explore the clinical value of ultrafast DCE-MRI.

## ABSTRACT

Breast dynamic contrast-enhanced (DCE)-MRI refers to MR imaging techniques with temporal resolution of 2 minutes or less to assess the changes of contrast uptake and washout in tumors. Recent technological advances realize various combinations of spatial and temporal resolution of breast MRI. Refined quantification (K<sub>trans</sub>, V<sub>e</sub>, K<sub>ep</sub>) of exchange of contrast agent between vascular space and interstitial space provide sophisticated hemodynamic information. Pre-contrast with only one post-contrast image makes MRI screening more feasible by reducing time and cost while maintaining diagnostic performance. DCE-MRI with a 4 to 7-second temporal resolution during the first minute before a standard image acquisition shows the potential to improve lesion conspicuity and characterization. This session will focus on the review of variations of breast DCE-MRI.

### RC315-12 Agreement between Radiologist-Assigned Categories and Quantitative Measures of Background Parenchymal Enhancement on Breast MRI

Tuesday, Nov. 27 11:00AM - 11:10AM Room: Arie Crown Theater

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## PURPOSE

Because background parenchymal enhancement (BPE) on breast magnetic resonance imaging (MRI) reflects the volume and intensity of contrast uptake, quantitative values of enhancement can be measured by 1) averaging the voxels of enhancement (PE = percent enhancement) above a pre-defined threshold, 2) computing the total volume of FGT that enhances above the threshold value (absolute volume of BPE), and 3) estimating the percentage of breast tissue that enhances above the threshold value relative to the total breast volume (BPE%). We developed a semi-automated segmentation algorithm to extract these quantitative measures of BPE. In this study, we investigated the agreement of computed measures of BPE with radiologist-assigned categories.

## METHOD AND MATERIALS

In this IRB approved HIPAA compliant retrospective study, we identified 123 patients with breast MRI performed for screening indications. As previously described, the breast segmentation algorithm co-registers pre- and post-contrast T1-weighted fat-suppressed and non-fat-suppressed sequences. Active contours method merged chest components and non-fat voxels were clustered using Otsu's method to identify fibroglandular tissue (FGT) voxels. Within the segmented FGT on the first post-contrast phase, we computed median and inter-quartile ranges for absolute volume of BPE and BPE% using a PE=30% threshold. Student's t-test evaluated BPE volume and BPE% by radiologist-assigned categories.

## RESULTS

Using the previously described 30% threshold, median and inter-quartile ranges for the volume of BPE by radiologist-assigned category were as follows (cm<sup>3</sup>): minimal (57.2, 24.4-100.1), mild (41.8, 30.7-65.4), moderate (70.6, 43.5-111.1), marked (67.1, 54.3-137.9). BPE% median and inter-quartile ranges were as follows (%): minimal (3.5, 1.7-5.5), mild (3.2, 1.7-4.6), moderate (4.7, 2.7-7.4), marked (5.7, 4.0-10.0). BPE volume and BPE% differed significantly between minimal/mild and moderate/marked radiologist-assigned categories (p=0.030 and 0.004, respectively) (Figure: Box plot of BPE% by BPE category).

## CONCLUSION

Quantified BPE volume and BPE% were significantly different between minimal/mild and moderate/marked radiologist-assigned categories.

#### **CLINICAL RELEVANCE/APPLICATION**

Given the inter-reader variability in BPE categorical assessments, the development and validation of quantitative measures is a necessary step towards incorporation of BPE into future risk prediction models.

#### **RC315-13 Correlation between 3T Multi-Parametric MRI and Molecular Subtypes of Breast Cancer**

Tuesday, Nov. 27 11:10AM - 11:20AM Room: Arie Crown Theater

##### **Participants**

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#### **PURPOSE**

To test whether 3T multi-parametric magnetic resonance imaging (mp-MRI) provides information related to molecular subtypes of breast cancer.

#### **METHOD AND MATERIALS**

Women with mammographic or US findings of breast lesions (BI-RADS 4-5) underwent 3T mp-MRI (DCE, DWI and MR spectroscopy). DCE-MRI was evaluated by classifying the wash-in/wash-out curve in three classes (I-III). DWI was used to calculate the mean ADC value within a region of interest centered on the tumor. MR spectroscopy (MRS) was evaluated by means of the signal-to-noise ratio (SNR) of the total choline peak (tCho). The histological type of breast cancer was assessed. Estrogen-receptor (ER), progesterone-receptor (PgR), Ki-67 status and HER-2 expression, assessed by immunohistochemistry (IHC), were used to identify four molecular subtypes: Luminal-A, Luminal-B, HER2-enriched and triple-negative tumors. Non-parametric tests (Kruskal-Wallis, k-sample equality of medians, and Mann-Whitney) and logistic regression were performed to investigate correlations between mp-MRI features (lesion volume, margins, ADC, type of DCE curve, and tCho SNR) and molecular subtypes.

#### **RESULTS**

483 patients (505 lesions) were included in the study. Volume was smaller in Luminal-B and larger in triple-negative tumors (non-parametric tests,  $p < 0.03$  and  $p < 0.004$ , respectively). A prevalence of irregular margins was observed in triple negative tumors ( $p < 0.01$ ). The type of DCE curve was significantly different in Luminal-A (lack of type III curves compared to average,  $p < 0.03$ ). ADC values were higher in Luminal-A ( $p < 0.04$  and  $p < 0.016$  in non-parametric tests and logistic regression, respectively). tCho SNR was higher in triple-negative tumours ( $p < 0.05$  and  $p < 0.01$ ).

#### **CONCLUSION**

A significant correlation was found between some MRI features and molecular subtypes of breast tumors. The strongest correlations were observed between Luminal A tumors and ADC, Luminal A tumors and DCE-MRI findings, Triple negative tumors and tCho SNR. These results warrant further research to improve the prognostic value of multi-parametric MRI.

#### **CLINICAL RELEVANCE/APPLICATION**

Significant correlations were observed between multi-parametric MRI features and molecular subtypes of breast tumors. Further research is needed to improve the prognostic value of mp-MRI.

#### **RC315-14 Apparent Diffusion Coefficient Difference Value on Diffusion-Weighted Imaging: Association with Distant Metastasis-Free Survival of Patients with Invasive Breast Cancer**

Tuesday, Nov. 27 11:20AM - 11:30AM Room: Arie Crown Theater

##### **Participants**

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#### **PURPOSE**

To investigate whether apparent diffusion coefficient (ADC) parameters on diffusion-weighted imaging (DWI) are associated with distant metastasis (DM)-free survival in patients with invasive breast cancer.

#### **METHOD AND MATERIALS**

This retrospective study was approved by the institutional review board. The requirement to obtain informed consent was waived. Between June 2013 and June 2014, 258 consecutive women (mean age, 50.9 years; age range, 23-85 years) with newly diagnosed invasive breast cancer who underwent preoperative breast MR imaging with DWI were evaluated. All DWI were retrospectively reviewed by two radiologists blinded to the clinical information. The mean, minimum, and maximum ADC values were measured by

manually placing regions of interest within the lesions and the ADC difference value (which is the difference between minimum and maximum ADC) was calculated to evaluate intratumoral heterogeneity. Cox proportional hazards models were used to reveal the associations between ADC parameters and DM-free survival after adjusting for clinicopathological factors.

## RESULTS

In 25 (9.7%) patients, DM developed without prior locoregional recurrence at a mean follow-up of 48.7 months. The mean of ADC difference value was significantly higher in patients with DM than in those without DM ( $0.781 \times 10^{-3} \text{mm}^2/\text{s}$  vs.  $0.620 \times 10^{-3} \text{mm}^2/\text{s}$ ,  $P = .007$ ). Kaplan-Meier survival analysis showed that patients with high ADC difference value ( $>0.793 \times 10^{-3} \text{mm}^2/\text{s}$ ) had shorter DM-free survival times compared with those with low ADC difference value ( $\leq 0.793 \times 10^{-3} \text{mm}^2/\text{s}$ ) (log-rank test;  $P < .001$ ). Furthermore, multivariate Cox proportional hazards analysis showed that a high ADC difference value ( $>0.793 \times 10^{-3} \text{mm}^2/\text{s}$ ) (hazard ratio [HR] = 3.448; 95% confidence interval [CI]: 1.567, 7.586;  $P = .002$ ), presence of axillary node metastasis (HR = 5.101; 95% CI: 2.127, 12.234;  $P < .001$ ), and estrogen receptor negativity (HR = 2.429; 95% CI: 1.104, 5.343;  $P = .027$ ) were associated with worse DM-free survival.

## CONCLUSION

High ADC difference value on DWI was significantly associated with worse DM-free survival of patients with invasive breast cancer.

## CLINICAL RELEVANCE/APPLICATION

Quantitative analysis of ADC difference value as a biomarker of intratumoral heterogeneity can be used to identify a subgroup of breast cancer patients at higher risk of developing distant metastasis.

### RC315-15 **Bradiomics (Breast Radiomics) Can Improve Breast Cancer Detection: Preliminary Clinical Results Using Multivariate Magnetic Resonance Tensor Modeling Fitting**

Tuesday, Nov. 27 11:30AM - 11:40AM Room: Arie Crown Theater

#### Participants

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## PURPOSE

To evaluate performance measurements of a radiomics model breast lesions extracted from 30 directions fitting of MR images without gadolinium enhancement.

## METHOD AND MATERIALS

Research ethics board approved this prospective study including data of 269 MR studies from patients of 3 institutions. All consented women presented with clinically/imaging suspicious or a biopsy proven breast cancer and an indication for dynamic contrast-enhanced (DCE) breast MRI. Before gadolinium injection, diffusion MR imaging (b values, 0, 800 sec/mm<sup>2</sup>) was performed using a dedicated 3.0T scanner with 16-channel breast coil. A total of 7 readers independently assessed DCE where BPE, lesion size and BIRADS category for each breast were recorded. Two readers blind to DCE results in consensus assessed the 11 features extracted from pixel-by-pixel fitting modeling optimized to lambda-1 values. Histopathology was used as the gold standard. Adequate statistical tests were used to compare the diagnostic values

## RESULTS

There were 248 malignant and 37 benign lesions in 229 patients. 7 patients presented with bilateral cancers. The bradiomics feature tensor model reduced false-positive results from 57 to 29 (specificity 88.9% [95% IC 0.843-0.923]) and diffusion imaging alone was less sensitive 89.9% (95% CI 0.855-0.931) than the conventional reading of DCE that provided sensitivity of 95.1% (95% CI 0.916-0.973) and specificity of 78.2% (95% CI 0.727-0.83) at the threshold including in situ disease. Diagnostic accuracy was 89.41% (95% CI 0.8941-0.9190) for tensor modeling and 86.77% (95% CI 0.8358-0.8954) for DCE.

## CONCLUSION

The bradiomics model based on diffusion tensor allowed for similar diagnostic accuracy of obtained using clinical set reading DCE. This may translate to less recalls and improve clinical outcomes.

## CLINICAL RELEVANCE/APPLICATION

The use of MR techniques that lead to high diagnostic accuracy without IV contrast may play a role in the clinical set.

### RC315-16 **Computer-Aided Diagnosis (CAD)-assessed Kinetic Features of Invasive Breast Cancers: Correlation with Clinical-pathologic Prognostic Factors**

Tuesday, Nov. 27 11:40AM - 11:50AM Room: Arie Crown Theater

#### Participants

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**PURPOSE**

To investigate the association of kinetic features with clinical-pathologic factors in breast cancer patients using computer-aided diagnosis (CAD).

**METHOD AND MATERIALS**

Between July 2016 and March 2017, 85 patients with invasive breast cancers (mean, 1.8cm; range, 0.8-4.8cm) who had undergone preoperative 3.0T MR imaging and surgery were retrospectively enrolled. All MR image were processed using CAD, and kinetic features of tumors were acquired: peak enhancement, angio-volume, early and delayed enhancement profiles. The relationships between kinetic features and clinical-pathologic factors were assessed. Mann-Whitney test, Spearman's correlation test and binary logistic regression analysis were used for statistical analysis.

**RESULTS**

In correlation tests, CAD-assessed peak enhancement and angio-volume were significantly correlated with histologic grade, Ki-67 index, and tumor size:  $r = 0.355$  ( $P = .001$ ),  $r = 0.330$  ( $P = .002$ ), and  $r = 0.231$  ( $P = .033$ ) for peak enhancement,  $r = 0.410$  ( $P = .005$ ),  $r = 0.341$  ( $P < .001$ ), and  $r = 0.505$  ( $P < .001$ ) for angio-volume. Plateau component at delayed phase was significantly correlated with Ki-67 index ( $r = 0.255$  [ $P = .019$ ]), but correlated coefficient between rapid component at early phase and Ki-67 index did not reach statistical significance ( $r = 0.202$  [ $P = .063$ ]). In binary logistic regression analysis, higher peak enhancement was a significant independent predictor of higher histologic grade (odds ratio [OR] = 1.004; 95% CI: 1.001,1.008;  $P = .024$ ), larger angio-volume was a predictor of larger tumor size (OR = 1.384; 95%CI: 1.141, 1.679;  $P = .001$ ), higher plateau component was a predictor of negative estrogen receptor status (OR = 0.928; 95%CI: 0.877, 0.982;  $P = .010$ ), and both higher plateau component and angio-volume were predictors of higher Ki-67 index (OR = 1.051; 95%CI: 1.011, 1.094;  $P = .013$  for plateau component. OR = 1.178; 95%CI:1.023;1.356;  $P = .023$  for angio-volume).

**CONCLUSION**

Of the CAD-assessed preoperative breast MRI kinetic features, higher peak enhancement may predict higher histologic grade, larger angio-volume may predict larger tumor size, higher plateau component may predict negative estrogen receptor status, and both higher plateau component and angio-volume may predict higher Ki-67 index.

**CLINICAL RELEVANCE/APPLICATION**

CAD-assessed preoperative breast MRI kinetic features can be considered as a useful imaging biomarker reflecting clinical-pathologic prognostic factors.

**RC315-17 Correlation of MRI Texture Features With Tumor Infiltrating Lymphocytes and Pathologic Complete Response in HER2 Positive and Triple Negative Subtypes of Breast Cancer**

Tuesday, Nov. 27 11:50AM - 12:00PM Room: Arie Crown Theater

**Participants**

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**PURPOSE**

To evaluate associations of quantitative MRI texture features and tumor infiltrating lymphocytes (TIL) levels in HER2+ and triple negative (TN) subtypes of breast cancer (BC) receiving neoadjuvant chemotherapy (NAC), as potential prognostic non-invasive imaging markers for pathologic complete response prediction (pCR).

**METHOD AND MATERIALS**

Retrospective review of BC patients who had MRI at staging, neoadjuvant chemotherapy and surgery from January 1, 2008 through December 31, 2015 was performed. Demographic, imaging, and pathologic data including TIL levels were documented. Quantitative MRI texture analysis was performed using 3 types of textural features (TF): local binary patterns (LBP), gray-level co-occurrence matrix (GLCM), and threshold adjacency statistics (TAS). Associations between MRI quantitative TF, TIL levels, and pCR were evaluated by Pearson correlation and logistic regression.



## **RESULTS**

There were 50 HER2+ and 38 TN patients (median age 51 years, range 29-59) with pretreatment MRI and TIL status for analysis; 27 HER2+ patients and 15 TN patients had pCR at surgery. For HER 2+ patients 9 TF significantly correlated with pCR ( $p < 0.05$ ): f1 (angular 2nd moment), l3 (75 percentile), l4 (standard deviation), t1-t6 (adjacency 0-5). Four TF were significantly associated with high TIL levels ( $p < 0.05$ ): texture l4 (standard deviation), t2 and t3 (adjacency 1 and 2). Additional 4 TF had weak association with TIL ( $p < 0.1$ ): feature f8 (sum entropy), t1, t3 and t4 (adjacency 0, 3 and 4). Three TF were significantly associated with both, pCR and TIL ( $p < 0.05$ ): texture l3 (75 percentile), l4 (standard deviation), t9 (adjacency 8). For TN patients 4 TF f2 (contrast), t1, t3 and t4 (adjacency 0, 2, 3) were significantly associated with pCR ( $p < 0.005$ ). No TF were significantly associated with TIL levels for TNBC, only t3 and t4 (adjacency 4 and 5) showed weak association with TIL levels ( $p < 0.1$ ).

## **CONCLUSION**

Quantitative tumor MRI texture analysis in HER2+ BC showed 9 TF associated with pCR, 8 TF with TIL and 3 TF with both pCR and TIL; for TNBC 4 TF were associated with pCR, and 2 TF weakly associated with TIL.

## **CLINICAL RELEVANCE/APPLICATION**

Analysis of associations of MRI quantitative TF with pCR and TIL in HER2+ and TNBC may help to develop prognostic non-invasive imaging markers for treatment response prediction.