UCSF Helen Diller Family Comprehensive Cancer Center

Predicting recurrence of invasive lobular cancer: Making a case for DCE-MRI derived features in the neoadjuvant setting

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San Antonio Breast Cancer Symposium® - December 8-11, 2020

Background

- Invasive lobular carcinoma (ILC) comprises 10-15% of breast cancers.
- ILC poses a diagnostic challenge due to its diffuse, infiltrative growth pattern, which may be occult on mammography and ultrasound.
- Treatment is also challenging as patients with ILC achieving pathologic complete response at lower rates than patients with invasive ductal carcinoma.
- Recent studies have looked at breast MRI for ILC rendering mixed results.
- We investigate imaging features derived from breast MRI to characterize ILC and predict recurrence-free survival (RFS) after neoadjuvant therapy.

Methods

- Retrospective review of patients with ILC at a single institution between 1998-2017.
- Patients were included if they received neoadjuvant chemotherapy (NAC) or neoadjuvant endocrine therapy (NET) and underwent pre- and post-treatment breast MRIs.
- Breast MRIs were analyzed for pre-treatment, post-treatment, and percent reduction (Δ) in longest diameter (LD), functional tumor volume (FTV), and signal enhancement ratio (SER)
- SER is the ratio of early to late enhancement on breast MRI, and reflects tumor vascularity.
- FTV is the sum of all image voxels of a 3D region of interest that are above a 70% enhancement threshold, and it represents the approximate volume of biologically active tumor.
- Univariate analysis was done to compare breast MRI features of patients receiving NAC or NET, and to compare breast MRI features with clinicopathologic features.
- Multivariate log-rank test an Cox proportional hazards were used to identify associations between breast MRI features and RFS.

Results

- 76 patients were included with a mean follow-up time of 4.9 years.

Figure 1. DCE-MRI for a patient with ILC treated with NAC. (A) Pre-treatment showing tumor (yellow box). (B) FTV calculation overlayed. Red areas contain SER (white arrow) (C) Post-treatment.

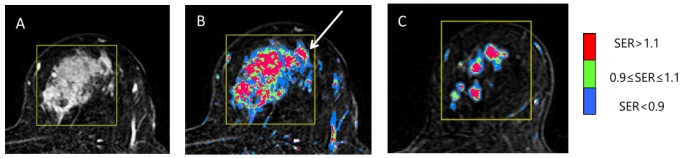

Table 1. Patient and tumor characteristics. Patients in the NAC cohort were significantly younger, had significantly higher stage, and showed a trend towards having more HER2 positive tumor receptor subtype.

	Overall (n=76)	NAC (n=42)	NET (n=34)	P value
Age (mean +/- SD, years)	57.4 +/- 9.4	55.0 +/- 8.4	60.3 +/- 9.8	**0.013**
Overall stage				**<0.001**
1	36 (47.4%)	11 (26.2%)	25 (73.5%)	
2	25 (32.9%)	21 (50%)	4 (11.8%)	
3	15 (19.7%)	10 (23.8%)	5 (14.7%)	
Receptor subtype (n=71)				0.061
ER+PR+HER2-	38 (53.5%)	18 (43.9%)	20 (66.7%)	
ER+PR-HER2-	21 (29.6%)	12 (29.3%)	9 (30%)	
HER2+	11 (15.5%)	10 (24.4%)	0 (0%)	
Triple negative	1 (1.4%)	1 (2.4%)	1 (3.3%)	
ILC Grade (n=73)				0.128
Low	26 (35.6%)	11 (28.2%)	15 (44.1%)	
Intermediate	44 (60.3%)	25 (64.1%)	19 (55.9%)	
High	3 (4.1%)	3 (7.7%)	0 (0%)	

Results

Table 2. Comparison of MR imaging features. NAC cohort had significantly larger LD and FTV on pre-treatment MRI. No difference in baseline SER. Post-treatment measurements did not differ. NAC cohort had significantly greater reduction in FTV.

	Overall (n=76)	NAC (n=42)	NET (n=34)	Δ (NAC-NET)	*P-value*
Pre-treatment (median, IQR)					
LD (cm)	2.7, 1.6-5.4	4.6, 2.5-7	1.8, 1.4-3.2	2.8	**0.0006**
FTV (cc)	5.8, 2.2-16.4	8.7, 4.1-24.2	3.0, 0.9-8	5.7	**0.0004**
SER	0.9, 0.8-1.0	0.9, 0.9-1.0	0.9, 0.8-1.1	0	0.8335
Post-treatment (median, IQR)					
LD (cm)	1.1, 0-1.9	1.0, 0-1.8	1.3, 0-1.9	-0.3	0.6071
FTV (cc)	0.5, 0.1-1.8	0.3, 0.1-1.8	0.7, 0.3-1.8	-0.4	0.2196
SER	0.9, 0.8-1.0	0.8, 0.8-1.0	0.9, 0.8-1.1	-0.1	0.2321
Percent reduction (%)					
LD	44.6, 15.1-100	79.6, 33.8-100	33.8, 10.1-100	46.6	0.0958
FTV	93, 72.5-97.4	95.8, 90.7-99.1	72.6, 43.1-94.5	23.2	**<0.0001**
SER	8.5, -11.1-19.7	10.7, -6.0-21.8	1.9, -15.1-17.9	8.8	0.3041

- Multivariate Cox proportional hazards model including all patients in the cohort, ***higher pre-treatment peak SER was significantly associated with worse RFS regardless of neoadjuvant treatment type when adjusting for age, stage, receptor subtype, and tumor grade (HR = 1.3, p=0.005, 95% CI 1.1-1.6).***
- Neither LD nor FTV were associated with RFS on multivariate analysis.

Conclusions

- SER derived from DCE-MRI may help predict RFS for ILC patients undergoing NAC and NET.
- Further investigation is needed for FTV, which has been validated in larger, more heterogenous cohorts of breast cancer patients.