Accuracy of MRI after neoadjuvant therapy for invasive lobular carcinoma of the breast

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San Antonio Breast Cancer Symposium® – December 4-8, 2018

Background

Invasive lobular carcinoma (ILC) has higher rates of false negative imaging than invasive ductal carcinoma, and lower rates of neoadjuvant therapy (NAT) use. We evaluated the accuracy of magnetic resonance imaging (MRI) of the breast after neoadjuvant treatment, and investigated whether imaging change correlated with disease free survival.

Methods

- Queried a database of 674 ILC cases treated at UCSF from 1981-2017 and identified all patients treated with NAT. Excluded cases where post-NAT MRI report was not available.
- Recorded BIRADS descriptors of findings (including characteristics of masses versus non mass enhancement [NME]), maximal tumor diameter, and subjective radiologist comments on interval change.
- Used Fisher's exact & chi-squared tests, Pearson's correlation, & Kaplan Meier analyses in Stata 14.2.

Table 1. Patient and tumor characteristics.

	Neoadjuvant chemotherapy (n=59)	Neoadjuvant endocrine therapy (n=42)	P value
Mean age, range	53.6, (28.9-74.3)	61.3, (41.1-83.6)	0.0002
Biomarker and receptor status			0.105
ER+ PR+ HER2-	29 (53.7%)	23 (62.2%)	
ER+ PR-,HER2-	14 (25.9%)	13 (35.1%)	
ER- PR- HER2-	1 (1.9%)	0	
HER2+	10 (18.5%)	1 (2.7%)	
Grade			0.076
1	14 (25.0%)	16 (38.1%)	
2	37 (66.1%)	26 (61.9%)	
3	5 (8.9%)	0	
Pathologic stage			<0.001
I	17 (28.8%)	28 (66.7%)	
II	26 (44.1%)	6 (14.3%)	
III	16 (27.1%)	8 (19.1%)	
Mean follow-up time (years, 95% confidence interval)	5.6 (4.5-6.7)	5.1 (3.8-6.3)	0.48

Table 2. Availability of pre- and post-NAT MRI data

	Number of cases
Had MRI prior to NAT	92 (91.1%)
Had MRI after NAT	101 (100%)

Table 3. Imaging findings on post-treatment MRI.

	Non-mass enhancement	No non-mass enhancement
Mass	33 (33.3%)	43 (43.4%)
No mass	18 (18.2%)	5 (5.1%)

Results

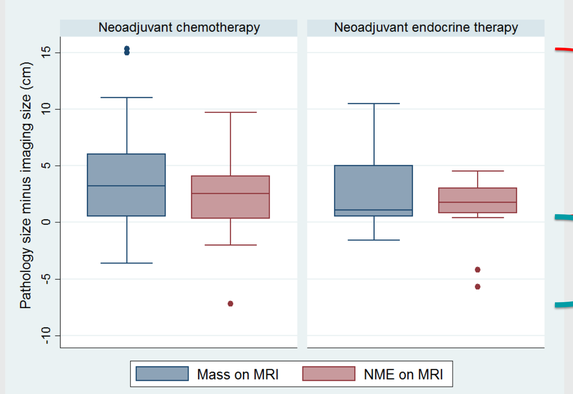


Figure 1. Box plots showing that MRI underestimates tumor size on pathology

MRI **underestimated** size by a mean of:
- 3.3 cm for masses
- 1.9 cm for NME

MRI overestimates size in few cases

For masses, ≥1 cm size discrepancy associated with positive margin (p=0.011).

Size discrepancy ≥1 cm :
- 46.4% positive margins

Size discrepancy <1 cm:
- 20.0% positive margins

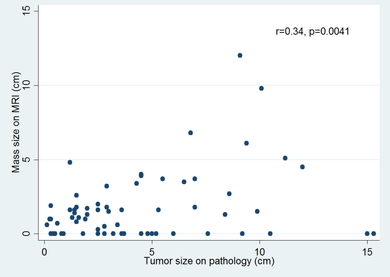


Figure 2a. Correlation between post-treatment MRI mass size and pathology size in cases with mass on post-treatment MRI

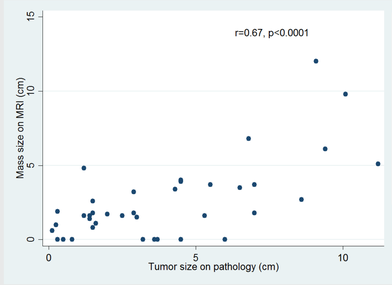


Figure 2b. Correlation between post-treatment MRI mass size and pathology size in cases with masses but no NME on post-treatment MRI

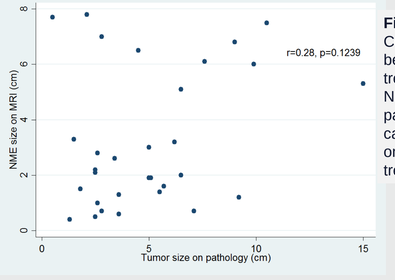


Figure 3a. Correlation between post-treatment MRI NME size and pathology size in cases with NME on post-treatment MRI

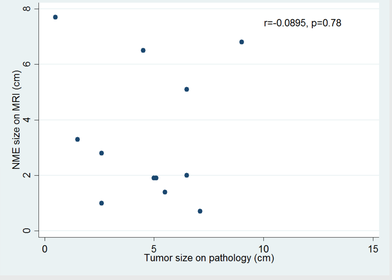
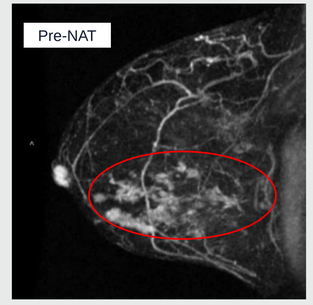
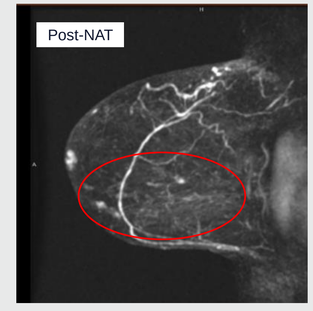


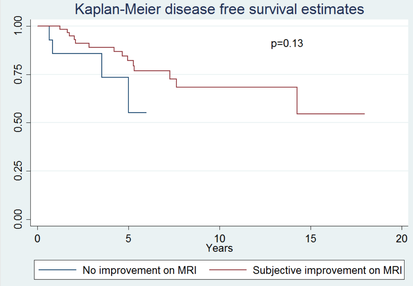
Figure 3b. Correlation between post-treatment MRI NME size and pathology size in cases with NME but no mass on post-treatment MRI

Figure 4. Disease-free survival and subjective interval changes noted on post-treatment MRI

Dynamic contrast enhanced MRI's showing interval change:
Top: pre-NAT image showing NME.
Bottom: post-NAT image. Near resolution of NME.







At four years post-diagnosis:

- Improvement on MRI: 89% disease-free survival
- No improvement on MRI: 73% disease-free survival

Subjective worsening of disease on MRI is associated with recurrence (p=0.001):

- Subjective interval progression: 80% recurrence rate
- No subjective interval progression: 18.3% recurrence rate

Conclusions

- Maximal tumor diameter on MRI after neoadjuvant therapy in ILC vastly underestimates tumor size on pathology. This underestimation is associated with positive surgical margins.
- The correlation between tumor size on MRI and pathology is best in cases that appear as a mass with no associated NME, but overall weak.
- These results suggest that MRI has relatively low accuracy in assessing extent of disease in the post-NAT setting in ILC, especially for NME.
- Maximal tumor diameter is unlikely the best measure for ILC after NAT; future work may identify additional imaging features that have higher accuracy, to guide surgical planning, with improved prognostic ability.

References and acknowledgments

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Porter AJ, Evans EB, Foxcroft LM, et al. Mammographic and ultrasound features of invasive lobular carcinoma of the breast. J Med Imaging Radiat Oncol 2014;58:10-10.

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