Assessment of the correlation between ADC values and Oncotype DX score in estrogen-receptor positive, lymph node negative, breast cancers

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TARGET AUDIENCE: Breast oncologists, clinicians and researchers

PURPOSE: The aim of this study was to evaluate the correlation between Apparent Diffusion Coefficient (ADC) value and Oncotype Dx scores in estrogen-receptor (ER) positive and lymph node (LN) negative breast cancers.

METHODS: This HIPAA compliant retrospective study consisted of 854 consecutive patients who underwent 3.0T MRI with DWI (b=0, 600 or 1000 s/mm^2) between January 2011 and January 2013 for BIRADS 4, 5 or 6 lesions. Patients who received neoadjuvant chemotherapy prior to MRI with lesions less than 0.8 cm, or DW images with artifacts or poor fat suppression were excluded. The ADC was analyzed on 219 malignant lesions in 195 patients. A region of interest was drawn within each lesion on DW images and cystic/necrotic portions were avoided. Results on histopathological analysis (histological type, grade, LN status) and molecular subtypes (classified as ER+, HER2+, and triple negative based on ER, PR, and HER2 status) and Oncotype DX scores were recorded. Based on gene expression, a quantitative recurrence score (RS) (estimated risk of recurrence in 10 years) is determined from 0 to 100, with stratification into low (RS < 18), intermediate (RS ranging from 18 to 30) or high (RS > 30) risk groups. Total of 43 patients had Oncotype Dx scores with all patients having available ADC data for b value of 600 and 32 patients only had ADC data for b value of 1000. Statistical analysis was performed on the data by using non-parametric Mann-Whitney's test for p values using Origin software (statistical significance was established at p= 0.05). The ADC values were measured in units of 10^{-3} mm^2/s.

Table 1: ADC values of breast lesions grouped with Oncotype DX Scores

	ADC_{600} ($x10^{-3}mm^2/s$)				ADC_{1000} ($x10^{-3}mm^2/s$)			
Oncotype Dx Score	N(%)	Mean	Std.Dev.	p value	N(%)	Mean	Std.Dev.	p value
Low	31(72)	1.120	0.200	0.110	22(69)	1.010	0.195	**0.012**
Intermediate	11(26)	1.010	0.103		9(28)	0.873	0.030	
High	1(2)	0.974	-		1(3)	0.847	-	

RESULTS: In the study population, there were 73 ER positive tumors with negative axillary LN. In 43/73 cases, Oncotype Dx score was required for the treatment planning. The mean size of the 43 lesions was 20 ± 12 mm; they were mostly invasive ductal carcinoma (30/43; 70%), with low (17/43) or intermediate (17/43) histological grade. The mean and standard deviation of ADC_{600} value of the 43 ER positive LN negative cancers eligible for the analysis was 1.080 ± 0.183; the mean ADC_{1000} value (data available for 32 cases) was 0.963 ± 0.173. As indicated in **Table 1**, the mean ADC value was higher in Oncotype DX score stratified low risk cancers than in intermediate risk cancers: a statistically significant difference was observed for ADC_{1000} values (**Fig 1**).

DISCUSSION: Several preliminary studies have evaluated ADC for its potential prognostic utility by analyzing its relationship with traditional and molecular prognostic factors; however, the impact of ADC on prognosis still remains to be validated. Our study is the first of its kind and correlates ADC values with Oncotype DX score. The results of our study will be useful in clinical decision-making for adjuvant therapy in patients where factors such as grade and Her2 status are not helpful. Our data suggest that lower ADC value may correlate with an increasing Oncotype DX score and consequently with an incremental estimate recurrence risk of cancer.

CONCLUSION: Our study indicates that ADC can be a potential surrogate biomarker for malignant lesion aggressiveness to support the Oncotype DX scores in ER positive, LN negative breast cancers.

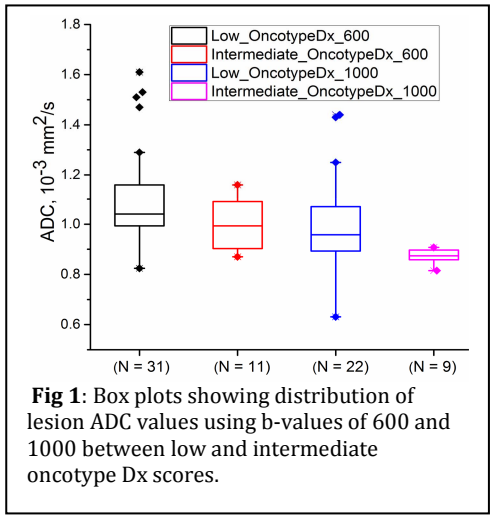

Fig 1: Box plots showing distribution of lesion ADC values using b-values of 600 and 1000 between low and intermediate oncotype Dx scores.

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