

# Evaluation of Contrast-enhanced Ultrasonography for Early Prediction of Response to Neoadjuvant Chemotherapy in Triple Negative Breast Cancer

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## Abstract

### Objectives

We aimed to determine whether contrast-enhanced ultrasonography (CEUS) can predict the early effects of neoadjuvant chemotherapy on triple negative breast cancer.

### Methods

The clinical responses of 20 consecutive patients with breast cancer (T1–2, N0–1, M0) to neoadjuvant chemotherapy between October 2012 and Feb 2016 were assessed using ultrasonography and contrast-enhanced ultrasonography before starting the therapy and after the treatment of 2 courses. Ascending slope (AS) of perfusion parameters for contrast-enhanced ultrasonography were created from time–intensity curves based on enhancement intensity and temporal changes to objectively evaluate contrast-enhanced ultrasonography findings. We investigated whether rate of change of ascending slope ( $\Delta$ AS) and tumor size ( $\Delta$  US) could predict pCR.

### Results

Eight (40.0%) of the 20 patients achieved pathological complete response.  $\Delta$ AS were significantly higher ( $-25.5 \pm 35.5$  vs.  $14.7 \pm 33.2$ ;  $P < 0.02$ ) in patients who achieved pCR than in those who did not. On the other hand,  $\Delta$ US of pCR and non-pCR did not significantly differ among tumors ( $-40.8 \pm 22.4$  vs.  $-21.4 \pm 20.6$ ;  $P = 0.06$ ). The AUC values for  $\Delta$ AS and  $\Delta$ US were 0.792 (95% CI, 0.579 - 1.000,  $P = 0.03$ ) and 0.729 (95% CI, 0.501 - 0.957;  $p = 0.09$ ), respectively. We set  $\Delta$ AS and  $\Delta$  US cut-offs for predicting pCR at -20.08 and - 33.75 based on the ROC curves. Clinical and pathological characteristics of the 20 patients are summarized in [table1]. Univariate (odds ratio, 2.71;  $p = 0.02$ ) and multivariate (odds ratio, 2.88;  $p = 0.03$ ) analysis showed that  $\Delta$ AS was the sole independent predictor of pCR [table2].

### Conclusion

$\Delta$ AS assessed with CEUS can help the physician to early predict the probability of achieving pCR or not.

Clinical and pathological characteristics of patients with breast cancer.

Characteristic	pCR (n)	Non pCR (n)	p
Clinical T status			
T1	1	1	0.71
T2	7	11	
Clinical N status			
Negative	5	7	0.85
Positive	3	5	
Nuclear Grade			
1 or 2	3	4	0.85
3	5	8	
$\Delta$ US (%)			
< -33.75	3	9	0.09
$\geq$ -33.75	5	3	
$\Delta$ AS (%)			
< -20.08	2	10	0.009
$\geq$ -20.08	6	2	

Univariate and multivariate logistic analysis of significant predictive factors for pCR in triple negative subtype

	Univariate analysis OR, 95% CI, p	Multivariate analysis OR, 95% CI, p
$\Delta$ US		
> -33.75	1.61, 0.72 - 34.7, 0.10	1.85, 0.51-79.1, 0.15
$\leq$ -33.75		
$\Delta$ AS		
> -20.08	2.71, 1.65-136.1, 0.02	2.88, 1.44-218.7, 0.03
$\leq$ -20.08		