Breast dynamic MR features including texture analysis associated with pathologic prognostic factors in triple negative breast cancers.

Bo La Yun[1], Sun Mi Kim[1], Mijung Jang[1], Hye Shin Ahn[1], Kyung Eun Cho[1], Bohyoung Kim[1], Hochul Kang[2], and Ji Young Kim[1]

[1]radiology, Seoul national Univ. Bundang Hosp., Seoungnam-si, Kyongki-do, Korea, [2]Seoul national Univ, Seoul, Korea

• TARGET AUDIENCE – breast radiologist, breast clinician, oncologist, MR researchers.

• INTRODUCTION - Breast cancers have inter- and intra-tumor heterogeneity. Molecular subtype of the breast cancer influenced to patient survival and recurrence rate. Especially, triple negative breast cancers (estrogen receptor(ER), progesterone receptor (PR) and HER2 receptor negative) are very aggressive with poor prognosis. MR features of triple negative breast cancer differ from other types.[1,2] Higher stage breast cancer have internal necrosis and heterogeneous enhancement. These features are common in triple negative breast cancer. It will be possible that more aggressive tumors have different texture features[3] compared to less aggressive tumors.
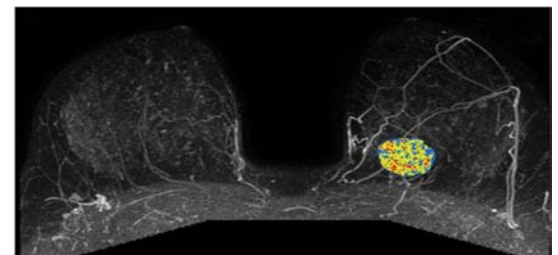
• PURPOSE – To assess the association of breast dynamic MR quantitative features including texture analysis with pathologic prognostic factors in triple negative breast cancers

• METHODS – Among 638 patients underwent breast cancer surgery between June 2012 and October 2013, Eighty three patients revealed triple negative breast cancer based on immunohistochemical staining (IHC). We excluded patient underwent primary systemic therapy. Finally, 37 triple negative breast cancer patients (all women, mean age 73 ± 24 years) enrolled our study. All patients were scanned prior to surgery on a 3.0 T Achieva scanner (Phillips). We acquired pre- contrast and five 3D dynamic images with fat saturation (SPAIR). For texture analysis, initial enhancement phase (1 min 30 sec after contrast injection) images

Figure1. A color map of dynamic MR (red: washout, yellow: plateau, blue: persistent

Mean ± SD	Histologic grade(1/2) (n=8)	Histologic grade (3) (n=29)
Plateau (%)	12.3 ± 15.0	25.7 ± 15.1
	Ki-67<14 (n=8)	Ki-67≤14 (n=29)
Rapid enhancement (%)	49.6 ± 23.1	71.8 ± 33.8
Medium enhancement (%)	50.3 ± 23.1	28.2 ± 33.7
Plateau enhancement (%)	9.7 ± 9.9	26.4 ± 15.4
Entropy	5.9 ± 0.7	6.7 ± 0.5
Uniformity	0.0038 ±0.0028	0.0016 ± 0.0009
	EGFR (-) (n=30)	EGFR(+) (n=7)
Maximum MR diameter (cm)	2.5 ± 2.3	4.5 ± 4.2
	Tumor size ≤2 (n=26)	Tumor size > 2 (n=11)
Maximum MR diameter (cm)	2.8 ± 3.3	3.1 ± 0.7
Entropy	6.3 ± 0.6	6.9 ± 0.3
Uniformity	0.0025 ±0.0019	0.0012 ± 0.0004

Table 1. Quantitative features of dynamic MR associated with prognostic factors

were used. The ROIs were drawn along the margin of the cancer in the largest diameter using in-house program. For dynamic feature analysis, MR CAD system (CADstream) was used. The percentage of rapid (>100% SI increase compared to pre-contrast image) and medium (40~60% SI increase compared to pre-contrast image) initial enhancement and delayed enhancement pattern were analyzed. The pathology results of specimens were categorized according to tumor size, histologic grade and axillary nodal status, and IHC result (Ki-67, p53, EGFR). The correlation of the texture and dynamic feature with each pathological prognostic factor were analyzed using Mann-Whitney U-test.

• RESULTS and DISSCUSION - High percentage of plateau enhancement was associated with high histologic grade (p= 0.029). High Ki-67 index (≥14%) tumors shows high percentage of rapid initial enhancement (p= 0.04) and low percentage of medium initial enhancement (p= 0.04) and high percentage of plateau delayed enhancement pattern (p= 0.007), high entropy (p=0.03) and low uniformity (p=0.04) value on texture analysis. Positivity of EGFR associated with large MR maximum diameter (p=0.03). More than 2cm size of the tumor associated with high maximum MR diameter (p=0.002) and high entropy (p=0.003) and low uniformity (p=0.005). The higher percentage of rapid initial enhancement and plateau delayed enhancement pattern on dynamic MR and texture feature such as entropy and homogeneity associated with poor prognostic factors.

• CONCLUSION – Initial and delayed enhancement pattern and texture features in breast dynamic MR were associated with traditional pathologic prognosis factors in triple negative breast tumor. These image features could predict preoperative breast cancer aggressiveness.

• REFERENCES 1. Sung JS et al., MR Imaging Features of Triple-Negative Breast Cancers. The breast journal 2013;19(6):643-649. 2. Youk JH et al., Triple-negative invasive breast cancer on dynamic contrast-enhanced and diffusion-weighted MR imaging: comparison with other breast cancer subtypes. European radiology 2012;22(8):1724-1734.3. Haralick RM et al., IEE transactions of systems, man, and cybernetics, vol. SMC-3, No.6, pp. 610-621, 1973