

Project title: From Value-Based Cancer Care To Precision Medicine In Oncology
Program title: Molecular taxonomy for optimization of breast cancer treatment

Correlating Pericyte Gene Expression Signatures with Pharmacokinetic Parameters of Dynamic Contrast Enhanced MR and Intravoxel Incoherent Motion Imaging in Invasive Breast Cancer

Wan-Chen Tsai^{1,2}, Kuo-Jang Kao³, Kai-Ming Chang³

蔡宛蓁，高國彰，張凱明

¹Department of Radiology, Koo Foundation Sun Yat-Sen Cancer Center, ² School of Medicine, National Yang-Ming University, ³Department of Research

Purpose: To investigate whether quantitative dynamic contrast material-enhanced (DCE) parameters and intravoxel incoherent motion imaging (IVIM) are correlated with pericyte gene expression signature in invasive breast cancer.

Material and Methods: With the IRB approval and signed informed consents from 119 breast cancer patients, we performed additional DCE breast MRI studies followed by diffusion-weighted images (DWI) at 11 b values values (from 0 to 1200 s/mm²) on a 1.5T MR system before breast surgery. Gene expression profiling was conducted on fresh biopsy or frozen surgical breast cancer tissue. Expression of six genes (ACTA2, ANGPT1, CSPG4, LAMB1, PDGFRB and RGS5) associated with pericytes was measured and a combined expression score was determined by principal component analysis. Associations between quantitative parameters from DCE MRI (K_{trans}, K_{ep}, V_e, V_p), IVIM (D, f and D*), and the kinetic curve analysis, and pericyte gene signature scores were evaluated using Spearman's correlation analysis with a significance level of 0.05.

Results: Pericyte gene signature score showed significant negative correlation with DCE MRI parameters k_{ep} (r=-0.2544, p=0.0052), v_p (r=-0.2429, p=0.0078) and max slope of signal increase (r=-0.2282, p=0.0133); and positive correlation with v_e (r=0.3275, p=0.0003) and D (r=0.2675, p=0.0037).

Conclusion: Invasive breast cancer with higher pericyte gene score showed lower perfusion pharmacokinetic parameters (k_{ep}, v_p), higher extra-vascular extracellular space (v_e) and less restricted diffusion, which means fewer blood vessels and less leaky in tumor. These associations revealed that DCE-MR parameters could be considered in guiding anti-angiogenesis treatment of breast cancer.