Purpose: Hemorrhagic transformation (HT) is a potential devastating complication of thrombolysis in patients with acute ischemic stroke (AIS). The purpose of this study was to evaluate the predictive role of MR perfusion biomarkers including increased microvascular permeability and decreased cerebral blood volume (CBV) in the infarction core to predict the risk of HT in a cohort of patients with AIS who received thrombolysis.

Methods: In this retrospective study, patients were included if they: had AIS, received thrombolysis, had pre-treatment MRI including dynamic susceptibility contrast (DSC) perfusion and had follow-up MRI for evaluation of HT within 7 days. MR perfusion data were processed employing a Bayesian probabilistic method\(^1\) to generate CBV and permeability coefficient (K2)\(^2\) maps. Using coregistered images, voxel-based K2 and rCBV values were obtained in the region of infarction (defined by ADC < 600 \(10^{-6}\) mm \(^2\)/s)\(^3\) and compared in patients with and without HT. Receiver operating characteristic (ROC) analysis was performed to determine the optimal parameter/s and threshold for predicting HT.

Results: Forty-eight patients met study criteria: mean (SD) age was 67.5 ± 15, median baseline NIHSS was 9 (IQR: 5-24) and mean infarct volume of 34 ± 18 ml (range 11-78 ml). Thirty percent of patients (14/48) had HT. The mean K2 value was significantly \((p<.0001)\) higher in patients with HT (0.24 ± 0.17) versus patients without HT (0.08 ± 0.03). Mean rCBV was significantly \((p=0.0001)\) lower in patients with HT (0.21 ± 0.02) compared to patients without HT (1.28 ± 0.66). ROC analysis showed a threshold and corresponding sensitivity/specificity of 0.104, 94%/84% for K2 and 0.38, 94/97% for rCBV. The combination of K2 and rCBV resulted in a higher discriminative power with an AUC of 0.97, sensitivity of 94% and specificity of 100%. In a multivariable logistic
regression model that included NIHSS and infarct volume, the combined K2-rCBV classifier was an independent predictor of HT.

**Conclusion:** Combined increased permeability and decreased CBV derived from MR perfusion have improved sensitivity and specificity, compared to either measure alone, for prediction of HT following thrombolysis. A larger clinical study is required to validate our results in an independent cohort.

**References:**

