Purpose: Tumor perfusion assessments with dynamic contrast enhanced (DCE) MRI have been focused on the overall degree of low DCE in tumors, without considering the characteristic geographic distribution of the perfusion pattern within the tumor. This study was to investigate the topographic and temporal perfusion patterns of cervical cancer and correlate them with treatment failure.

Methods: 101 cervical cancer patients were treated with external beam radiation therapy (RT), concurrent chemotherapy, and brachytherapy. The patients underwent serial DCE-MRI prior to RT start, in early-RT (at 20-25 Gy), and in mid-RT (at 45-50 Gy). The center slice of the tumor ROI was selected to find the number of pixels with signal intensity (SI) local maximum within the ROI (Num_max). After further separation of the ROI into central zone and peripheral zone, Num_max was divided into two terms Num_max_C (for central zone) and Num_max_P (for peripheral zone). The 3 parameters for tumor pixel SI local maximum (Num_max, Num_max_C, Num_max_P) were compared, and correlated with local control and patient survival.

Results: More pixels with SI local maximum dwell in the peripheral zone of the tumor ROI than in the central zone (Num_max_P > Num_max_C). At pre-RT, both Num_max and Num_max_P correlate with local tumor control ($p= 0.029, 0.005$ respectively), and with disease-specific survival ($p= 0.012, 0.007$ respectively). But the central zone Num_max_C does not correlate with local control or survival. Similar results remain in early-RT and mid-RT DCE-MRI study of tumor SI local maximum patterns.

Conclusions: This preliminary study suggests that tumor perfusion micro topography features revealed by DCE-MRI influences tumor primary dose response, on which the tumor peripheral region is more relevant than the central region. This could potentially impact on the treatment plan design. And the predictive micro topography features can be detected even before the treatment starts.