Purpose: To propose using Dynamic Contrast Enhanced- MRI (DCE-MRI) for a high-resolution, pre-treatment evaluation of lung perfusion in patients with lung cancer who will receive radiation therapy. The second goal is to benchmark the performance of DCE-MRI against the gold standard: scintigraphy perfusion-scan.

Methods: DCE-MRI and scintigraphy V/Q scans were acquired for 4 lung cancer patients prior to radiation therapy. DCE-MRI relies on a single bolus injection of a paramagnetic contrast agent (Gd-DTPA) that produces a transient signal enhancement on a T1 sensitive imaging sequence. By mapping the signal changes into contrast agent concentration curves, one can use techniques developed for indicator dilution to calculate perfusion estimates of pulmonary blood flow (PBF), blood volume, and mean transit time. The images were corrected for volumetric changes induced by respiratory motion using a non-rigid registration technique. 3D masks of the right and left lung fields were manually contoured on the initial MRI volume using MATLAB and applied to the PBF maps. These maps were subsequently collapsed in the A-P-dimension to create coronal 2D projections consistent with the scintigraphy V/Q images. Left and right lung fields were divided into 3 sections of equal height, and signal intensity computation was carried out analogous to the analyses performed on scintigraphy scans. Kendall's tau rank correlation coefficients were used to compare lung perfusion estimated using DCE-MRI to the perfusion portion of the V/Q studies.

Results: The non-parametric Kendall's tau correlation coefficient ranged between 0.93-0.96 for PBF and scintigraphy perfusion. There is a 2X improvement in spatial resolution when compared to SPECT-perfusion.

Conclusions: There was a strong correlation between the DCE-MRI and scintigraphy V/Q estimates of perfusion with statistically significant rank correlations. These results indicate that DCE-MRI is a viable high-resolution imaging modality for the evaluation of pre-treatment lung perfusion in patients with lung cancer.