AbstractID: 13632 Title: A Quantitative Metric Derived from DCE MRI for Assessment of Liver Response to Radiation therapy

Purpose: To investigate a quantitative metric derived from dynamic contrast enhanced (DCE) liver MR imaging for hepatic perfusion response to radiation therapy (RT).

Materials and Methods: Ten patients with intrahepatic cancers were treated by fractionated conformal RT in a dose range of 48-82 Gy, and imaged with DCE MRI before, during, 1 month and 2 month after the therapy. Voxel-by-voxel hepatic arterial perfusion *(Fa)* and portal venous perfusion *(Fp)* were estimated using a dual-input single-compartment model. To overcome some of the challenges in estimation of hepatic perfusion from DCE MRI, a portal venous perfusion ratio (PVPR) *(100×Fp/(Fa+Fp))* was evaluated for liver perfusion dose-response. Hepatic perfusion maps were co-registered to the dose distribution via registration with the treatment planning CT. The liver voxels having PVPR between 80% and 95% before RT were considered as "normal" tissue. The relation between perfusion and dose in the "normal" liver was assessed by the venous-perfusion-ratio dose-response function.

Results: The PVPR in the "normal" liver regions 1 month after RT decreased compared to pre RT. The extent of the decrease was linearly correlated with the dose accumulated to the end of RT (R^2=0.93). Substantial individual variations of the PVPR decreases were observed 1 month after RT.

Conclusions: Our study shows dose-dependent perfusion changes in local liver regions. There is substantial variability in the sensitivity of liver perfusion to irradiation. The PVPR may characterize the liver perfusion change in response to radiation and might be a metric for predicting radiation toxicity in the liver. The study is supported in part by R21 CA126137 and 3 P01 CA59827.