

AbstractID: 14314 Title: Observation of reduction and subsequent recovery of hepatic perfusion in patients undergoing focal radiotherapy

Purpose: To investigate liver perfusion changes and their correlation with dose during the course of and after radiation therapy using dynamic contrast enhanced (DCE) MRI.

Materials and Methods: Ten patients who had intrahepatic cancers and were treated by fractionated conformal RT or SBRT participated in a prospective MRI protocol. The planned doses to the tumors ranged from 48-82 Gy, and were planned to ensure liver NTCP values of 10% or less. DCE MRI was acquired pre RT, after receiving ~50% of planned dose, at the last week of RT, and 1 month after the completion of therapy. Voxel-by-voxel hepatic arterial perfusion (F_a) and portal venous perfusion (F_p) were estimated using a dual-input single-compartment model. A portal venous perfusion ratio ($PVPR = F_p \times 100 / (F_a + F_p)$) was evaluated for liver perfusion dose-response. After hepatic perfusion maps were co-registered to the dose distribution (corrected to 2 Gy equivalent fraction size) via registration with the treatment planning CT, the relationship between PVPR and dose in the “normal” liver was assessed by the venous-perfusion-ratio dose-response function.

Results: Dose-dependent decreases in the “normal” tissue regions were observed at the last week of and 1 month after the completion of RT, but minimum after the tumors received ~50% planned dose. The extent of the decreases was patient dependent. In 7 of the 10 patients, there was partial recovery of the initial decrease in the PVPR at 1 month after RT compared to the values in the same regions at the last week of RT.

Conclusions: Further characterization of the initial decreases in hepatic perfusion and its recovery may help us to better understand the tolerance of radiation doses in individual patients with the potential to adopt patient treatment and/or plan re-treatment. The study is supported in part by R21 CA126137 and 3 P01 CA59827.