AbstractID: 11485 Title: Novel Hyperpolarized C-13 Metabolic Imaging Technique to Monitor Radiation-Induced Tissue Damage in vivo at Moderate Radiation Doses

Purpose: Recent introduction of nuclear hyperpolarization technique to liquid state enabled in vivo detection of ^{13}C labeled endogenous metabolites with MR spectroscopy imaging (MRSI). We investigate feasibility of employing this novel technique to assess radiation-induced tissue damage, which could result in radiotherapy, at moderate doses. **Method and Materials:** In this study we used Wistar male rats weighing 200-450 g to make the model by unilaterally irradiating one kidney with a collimated beam of X-rays (200 kVp, HVL 1.0 mm Cu). Kidney was chosen because it is a radiosensitive organ and provides internal control. Initially, rats received dose of 15 Gy and were subjected to ^{13}C magnetic resonance spectroscopy imaging (MRSI) at 21 days of postirradiation time. In MRSI, rats were intravenously injected with a hyperpolarized solution of 80 mM [1–^{13}C]pyruvate. Hyperpolarization was performed by using DNP technique in HyperSense^{TM} polarizer (Oxford instruments). Fast chemical shift imaging (CSI) was performed at 3 T to acquire axial slices through both kidneys in every 6th second to measure spatial distribution of metabolites, pyruvate, lactate, and alanine. Animals were sacrificed after imaging to harvest kidney tissues for histopathology. **Results:** ^{13}C MR spectra in kidneys clearly show metabolism of pyruvate and its endogenous downstream products, lactate and alanine. Perfusion was visible as initial high concentration of pyruvate in vena cava vain subsequently distributed in kidneys producing lactate and alanine. We observe low lactate production is in the irradiated kidney in comparison to non-irradiated kidney. Further analysis is being performed, including histopathology, to justify imaging results. **Conclusion:** In over preliminary data, observed reduction of lactate production in the irradiated kidney in comparison to non-irradiated kidney suggests potential use of hyperpolarized ^{13}C metabolic imaging technique to distinguish and assess radiation-induced tissue damage in kidneys. Further analysis is necessary to assess radiation effects to confirm observations.