AbstractID: 10970 Title: Combined Dynamic Contrast Enhanced Magnetic Resonance Imaging (DCE-MRI) and Magnetic Resonance Thermal Imaging (MRTI) for Optimal Hyperthermia Treatment of Advanced Extremity Sarcomas: Fifteen Patients Update

Purpose: To deliver optimal hyperthermia (HT) treatments for patients with advanced extremity sarcomas using DCE-MRI and MRTI

Method and Materials: Patients were treated on a protocol using radiotherapy consisting of 45 Gy and once a week HT for 5 weeks in a setting that allows the use of a 1.5 T GE magnet for imaging. Pre- and post first HT treatment DCE-MR images were acquired and analyzed with software from iCAD Inc. (Nashua, NH) based on a full time point pharmacokinetics (PK) analysis that measures tumor's permeability (Ktrans) and extracellular volume fraction (Ve). Multi-slice temperature rise images were obtained using the proton resonance frequency shift technique during heating in a 140 MHz phased array HT applicator and compared to invasive temperature measurements. Thermal dose metrics were calculated and correlated with response and with the PK parameters.

Results: Fifteen patients were enrolled on this protocol; ten patients were heated. Permeability maps derived from DCE-MR images were used to guide the placement of the invasive catheter to span regions varying from high to low perfusion. The MRTI images were used to steer the power, with the intent of heating the tumor uniformly while maintaining surrounding normal tissue at lower temperatures. From the evaluable HT treatments, we achieved excellent correlation ($\Delta T<1^{o}C$) between the MRTI and invasive measurements. As a trend, patients that were either pathological complete or partial responders had a decrease in Ktrans. The Ve parameter showed no clear trend with pathological response or % necrosis. As expected, tumors that were more vascularized (higher Ktrans) heated less than tumors with a high degree of necrosis or fluid pockets.

Conclusion: DCE-MRI coupled with MRTI provides information on tumor environment that can improve planning, delivery, and evaluation of HT treatments.

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