The Use of Preclinical Imaging to Study Radiotherapy and Radiation Injury

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Abstract:

My presentation will cover three different projects from my lab which uses preclinical imaging to understand and characterize radiation-induced side-effects either from tumor treatment or accidental exposure. We specifically study the response of the brain and body to radiation exposure either for tumor treatment or through accidental exposure. First, I will present our preclinical pediatric cranial radiotherapy (CRT) models that reproduces the long-term toxicities including; endocrinopathies, delayed growth, and profound deficits in higher order cognitive function. These models are used to investigate how the acute and chronic inflammatory response, alterations in brain structure and functional networks contribute to cognitive dysfunction post-CRT. Second, I will present our work on using MR images to predict radiation therapy response in both preclinical and clinical datasets. Radiation therapy is a crucial component of brain tumor treatment therefore the ability to predict or detect radioresistance a priori is essential in development of effective treatment plans. We developed a work flow that utilized different machine learning algorithms to identify image features informative of treatment response and predict treatment response with good accuracy. Third, I will present our preclinical radiation models (whole and partial) that reproduces the major radiation syndromes often observed after a nuclear incident. Using our irradiated models we have used MRI, PET/CT and ultrasound imaging to investigate the acute and delayed effects after radiation exposure. We have found that these imaging modalities can be used to differentiate those exposed from those that are “worried-well”, monitor recovery of major organ system and predict fatality.

Host: Carlos J. Pérez-Torres