Preliminary finding using MRI to detect radiation induce brain injury in mice

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Radiotherapy has improved survival outcomes for central nervous system (CNS) malignancies. However, the negative impact of radiotherapy on the healthy tissue surrounding these malignancies, is increasingly becoming a concern. We aimed to investigate whether the employment of magnetic resonance imaging (MRI) techniques could be used to detect crucial aspects of the time-dependent effects resulting from the exposure of the CNS to ionizing radiation (IR). We hereby report preliminary MRI findings of a study examining the early delayed IR-induced CNS injury in adult CD-1 nude mice that had their right brain hemisphere exposed to a 20 Gy single IR dose by a Small Animal Radiation Research Platform (SARRP). T_2 mapping and multiple *b* value diffusion weighted imaging (DWI) with a range of observation times were acquired with a 7T small animal preclinical MRI scanner at 6 time-points: before irradiation and then at 1, 10, 17, 60 and 80 days post irradiation. The acquired T_2 mapping data indicated no significant change in actual T_2 values and revealed no significant deviation from normal mono-exponential decay. Similarly, DWI data with short observation times (20-80 ms) showed no significant deviation from Gaussian behaviour, suggesting the existence of no CNS microstructural changes due to IR. However, multiple *b* value DWI with a 200 ms observation time showed deviations from Gaussian behaviour, suggesting that the assessment of diffusion kurtosis imaging (DKI) could be informative for identifying early delayed radiation-induced brain injury in mice. Our promising MRI findings are examined in parallel with neuropathological observations in the brain tissue of these mice (obtained at 80 days post irradiation), resulting from the assessment of haematoxylin-eosin, cresyl violet, glial fibrillary acidic protein (GFAP) and Luxol fast blue staining in CNS structures of relevance (such as the hippocampus, fimbria, external capsule, thalamus and selected cortical regions).