Radiation-Dependent Demyelination in Normal Appearing White Matter in Glioma Patients, Determined Using Quantitative Magnetic Resonance Imaging

Anna Ljusberg, Ida Blystad, Peter Lundberg, Emelie Adolfsson and Anders Tisell

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What was your motivation for initiating this study?
Brain cancer, especially glioma, is an aggressive form of cancer with a poor prognosis. The treatment regime is very aggressive, and the quality of life of many patients is affected. Our motivation for the study was to improve both diagnostic tools and therapy assessment, as well as to increase understanding of how the brain reacts to the harsh treatment regime. We sought to prove that use of quantitative MRI (qMRI), which is both gentle and useful for these patients, creates opportunities for improvements in the future.

What were the main challenges during the work?
One of the main challenges was to identify the same structure each time, within a longitudinal study over two years, with MR examinations that were performed typically every third month. During that period, the structure of the brain changed due to surgery, swelling and oedema. When a 2D-sampling technique is used, there is also a consequence of how the slices are placed at different time points. Due to this, no fully automatic registration or segmentation could be used; instead a neuro-radiologist drew regions of interest manually in order to ensure a stable segmentation at all time-points.

What is the most important finding of your study?
One important finding is that qMRI can be used to detect and measure quantitative changes in the brain tissue and to visualise effects that cannot be observed in conventional MR images. Therefore, this research adds information about how the brain is affected both by the disease and by the treatment. This knowledge potentially can be used to investigate further how damage to the myelin concentration depends on the absorbed dose. Even though this study involved a small number of patients, a difference in response at two dose levels was observed. By enlarging the cohort, we hope to extend our knowledge and to include a wider range of clinically relevant dose levels.

What are the implications of this research?
The qMRI technique is a potentially valuable clinical tool with which to investigate patients with brain tumours, and we will continue our efforts to research the use of qMRI for this patient group. With larger cohorts we hope to be able to better detect treatment side effects, and eventually to optimise treatment to avoid, or minimise, its complications.

Anna Ljusberg
Department of Medical Radiation Physics, and Department of Health, Medicine and Caring Sciences, Linköping University, Linköping, Sweden
Center for Medical Image Science and Visualization (CMIV), Linköping University, Linköping, Sweden
Anna.ljusberg@regionostergotland.se