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"Can Biomarkers of Recovery be Determined Non-Invasively Using MRI in Degenerative Cervical Myelopathy Patients?"

Abstract:

Degenerative cervical myelopathy (DCM) is a degenerative disease of the spine that causes spinal cord compression, leading to neurological dysfunction. Surgical intervention decompresses the spinal cord, with the goal of maintaining neurological function and preventing further deterioration. Since DCM is a prevalent disease of the spine and decompression surgery is often the intervention recommended, identifying predictors of surgical outcome would be valuable. In clinical settings, prediction is an essential tool. Knowing a patient's surgical outcome can help determine who would benefit from surgery and assess their potential functional improvement. It has been hypothesized that ischemia and hypoxia influence the progression of DCM and can affect the effectiveness of decompression surgery. Unfortunately, it is challenging to measure spinal cord ischemia and hypoxia non-invasively due to its small size, surrounding bony structure, and respiratory/cardiac motion.

Our research has focussed on measuring spinal cord hypoxia and ischemia using MRI non-invasively. Initial work concentrated on comparing the severity of spinal cord compression, which was used as a proxy for hypoxia, to cortical reorganization in the motor areas of the brain, measured using functional MRI (fMRI). One limitation of this work was the assumption that compression severity indicated the presence of hypoxia in the spinal cord. This led to research focussing on optimizing and implementing chemical exchange saturation transfer (CEST) MRI in the cervical spinal cord. CEST is an MRI contrast that exploits the transfer of magnetic saturation from selectively excited endogenous protons to bulk water protons, resulting in a water signal reduction. pH-weighted CEST contrasts are produced by exploiting the pH dependence of the proton exchange rate. Since hypoxia alters tissue pH by anaerobic glycolysis, pH-weighted CEST images could indirectly measure tissue ischemia and hypoxia. Our work focused on optimizing the CEST contrast at 3.0 T, evaluating the reproducibility of 3D CEST along the spinal cord in healthy subjects, and determining the efficacy of different post-processing schemes in the spinal cord. Further work is currently being performed to compare the pH-weighted CEST measurements in the spinal cord of DCM patients to healthy controls.