Magnetic Resonance Elastography of the Brain

https://neurodegenerationresearch.eu/survey/magnetic-resonance-elastography-of-the-brain/

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Research Abstract

? DESCRIPTION (provided by applicant): The goal of this exploratory proposal is to validate magnetic resonance elastography (MRE) as a method that provides unique information about the progression of neuropathologies and, importantly, their response to therapy. Our team is one of the few worldwide that has established non-invasive mouse brain MRE using a customized setup with the highest spatial resolution and signal to noise ratio in the field. We hypothesize that this unique structural information (akin to a non-invasive intracranial “”palpation””) will allow one to follow changes in pathological processes that affect brain tissue elasticity, and even detect the appearance of “”compartments”” with different physical properties

during disease progression, which could help to model drug distribution and tailor therapies. We propose to study two neuropathologies that produce extensive changes in neural tissue morphology and physical properties, but with vastly different origins and time course. Alzheimer's disease (AD) will be studied in Aim 1. AD is a devastating disease affecting an estimated 5.2 million Americans and is an enormous public health issue. It is an example of a neuropathology in which brain stiffness may change slowly over time due to plaque deposition, formation of protein tangles, slow neuronal death and vascular changes. Malignant brain tumors (gliomas) will be studied in Aim 2. These fast growing tumors are the most common primary brain tumors and one of the types of cancer with the worst prognosis. Gliomas are an example where local changes in stiffness are rapidly expected due to tumor growth and vascular proliferation, and where changes in stiffness can provide information about response to therapy and vascular normalization. We will study the temporal progression of both diseases using MRE and will correlate our radiographic results with well-defined histological features and molecular markers in the diseased tissues, with the goal of establishing the value of MRE as a novel, high-contrast, imaging approach with diagnostic value. Moreover, in our glioma models we will study changes in elasticity (MRE) compared to tissue perfusion (DCE-MRI) resulting from conventional chemotherapeutic approaches (cytotoxic and anti-angiogenic), which will also be correlated with histological and molecular changes after imaging. This will allow us to establish the relevance of MRE for prognostic follow-up after tumor therapy. Successful achievement of these Specific Aims will allow us to demonstrate MRE as a novel brain imaging modality that can complement MRI to provide more comprehensive information about progression and response to therapy in these and other neural diseases.

Further information available at:

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