Develop imaging biomarkers for assessing glymphatic dysfunction in neurodegenerative diseases

開發神經影像生物標記物以預測神經系統疾病

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Research Background

In AD, a slowdown in glymphatic clearance is one of the key contributors to the formation of amyloid plaques. Only imaging approaches could reveal this dynamic in its natural form, and MRI is the only available clinical imaging modality to image the glymphatic system in humans. Our group has demonstrated a robust molecular MRI approach, called dynamic glucose-enhanced(DGE) MRI, that enables the detection of slow down glucose clearance in CSF in AD mice, based on a promising molecular mechanism CEST. This slow down clearance was observed in an early stage of AD when little or almost no plaques were found. Another CSF imaging approach, named magnetization transfer indirect spin labeling(MISL), detects the age-dependent CSF-tissue water exchange. Moreover, recently we have demonstrated that the protein-related changes in AD brain could be detected by CEST MRI at 3 T. In this project, we are going to develop a dynamic CEST MRI (DGE and MISL) based on our promising molecular imaging techniques, as a non-invasive and multiparametric assessment of the glymphatic system in AD. We will further apply this to monitor the potential AD treatments in mice. Finally, we will translate our approach to clinical scanners to assess small cohorts of normal subjects and dementia with our clinical experts from neurology and radiology. We anticipate this imaging readouts could serve as non-invasive clinical imaging biomarkers for an early diagnosis and disease staging of AD, and potential treatment monitoring.

Research Objectives

Objective 1: Monitor AD progression using dynamic CEST MRI in mouse models.

Objective 2: Investigate the sensitivity of dynamic CEST MRI to detect the factors that alter the glymphatic functions