Investigating the Associations Between the Perivascular Space, Age, and Cognitive Function in Cognitively Normal and Impaired Individuals

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Background and Hypothesis: Perivascular spaces (PVS) are a component of the glymphatic system, which is believed to help remove waste products from the brain. Dilated PVS have been correlated with normal aging and neurological conditions. In this study, we sought to evaluate the associations between age, PVS volume, and Montreal Cognitive Assessment (MoCA) score in cognitively normal participants (CN), as well as those with subjective cognitive decline (SCD), and mild cognitive impairment (MCI). We hypothesize that greater PVS volumes will be associated with lower MoCA scores.

Methods: PVS delineation was conducted on MRI images of participants from the Indiana Alzheimer's Disease Research Center (ages 62-89; with 9 CN, 5 SCD, 1 MCI). For image processing, the enhanced PVS contrast (EPC) was calculated by dividing T1-weighted images by T2-weighted images, followed by Frangi filter to capture the vessel-like PVS structure. Three blinded reviewers used the imaging software FSLeyes to analyze EPC and FLAIR images to correct the mask. Partial correlation was applied to PVS volume normalized to total brain volume and MoCA scores while controlling for age.

Results: A partial correlation between MoCA score and PVS volume was -0.24 ($p=0.40$) after controlling for age. The sample sizes were not sufficient to investigate if these correlations varied among the different research groups.

Scientific Implications: Our analysis suggests that enlarged PVS volume might contribute to decline in cognitive function, however, further work is needed to provide more insights to the pathologic alterations of PVS in individuals with cognitive complaints or impairment.