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CEREBROVENTRICULAR FLUID COMPLEXITY IN THE EARLY STAGES OF ALZHEIMER'S DISEASE

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Alzheimer's disease (AD) is the most common form of dementia, a clinical syndrome of progressive deterioration of cognitive abilities and ordinary daily functioning. In its early stages, AD presents itself as mild cognitive impairment (MCI), a state between normal ageing and dementia. The cerebroventricular CSF flow alterations between cognitive healthy controls (CHCs) and MCI patients have largely been ignored in the study of AD. In this work, subject-specific datasets are used. These were collected as part of the VPH-DARE@IT project, and prospective data collection was conducted. Thirty-five subject cases were used for the simulations (N = 20 cognitive healthy controls (CHC), and N = 15 MCI cases). In this work, we attempt to classify cerebrospinal fluid (CSF) flow within the cerebral ventricles of CHC and MCI subjects (including hypomotile and hypermotile flow dynamics [1]). Flow through the cerebral ventricles is solved using the multiphysics Computational Fluid Dynamics software, CFD-ACE+ (ESI Group, Paris, France), a finite-volume based flow solver. A 3D multiporoelastic model of perfused parenchymal tissue, coupled with an automated image-based model personalization workflow and a subject-specific blood flow variability model are integrated into a unified consolidated pipeline [2]. This consolidated pipeline is used to provide a detailed description of how the boundary conditions to the CFD model of the cerebroventricular system are acquired, along with additional insight into the region-specific (28 in total) CSF/ISF clearance, drainage, swelling, blood perfusion and intracranial pressure.

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