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Computational Study of Hemodynamic Nature in Patient-Specific Cerebrovasculature with Lenticulostriate Artery under ICA Stenosis Conditions TAEHAK KANG, Department of Mechanical Engineering, Chung Ang University, DEBANJAN MUKHERJEE, Department of Mechanical Engineering, University of Colorado Boulder, JEONG-MIN KIM, KWANG-YEOL PARK, Department of Neurology, College of Medicine, Chung Ang University, JAIYOUNG RYU, Department of Mechanical Engineering, Chung Ang University
— Lenticulostriate arteries play important role in cerebral circulation, especially in basal ganglia region. Deeper understanding of hemodynamic nature of LSA would grant more effective surgical or endovascular treatments. This is the first study to investigate hemodynamic changes in small cerebral artery, namely lenticulostriate artery (LSA), coupled with complete three-dimensional cerebral vasculature under carotid (ICA) stenosis conditions. For patient-specific study, patient CTA data with complete cerebral anatomy is obtained from STOP Stroke database, and computational reconstruction is carried out using open-source package, SimVascular. Petrov-Galerkin formulation is used to solve the fluid domain with pulsatile inflow and lumped three-element Windkessel outlet conditions. NASCET-based stenosis cases are applied to internal carotid artery for all patient-specific models, and their three-dimensional hemodynamic structure is visualized for comparison. We present the results in key hemodynamic properties and indexes such as VFR, MAP, and OSI. As a result, significant hemodynamic changes are shown in LSA and its cerebrovasculature under progressive ICA stenosis conditions.

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