

عنوان مقاله:

Numerical Study on Fluid-Structure Interaction in a Patient-Specific Abdominal Aortic Aneurysm for Evaluating Wall Heterogeneity and Material Model Effects on its Rupture

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خلاصه مقاله:

Abdominal Aortic Aneurysm (AAA) is one of the main cardiovascular diseases, which threatens human's health while it appears, develops and in crucial cases ruptures and leads to hemorrhage. In the current work, we aim to investigate numerically the transient blood flow in a patient-specific AAA model, while effects of wall compliance is considered by employing the fluid-structure interaction method. The AAA model is reconstructed from acquired CT angiographic data of a patient diagnosed with AAA and an intraluminal thrombus (ILT). For the comparison purposes two different material models, i.e. isotropic and anisotropic are considered. Additionally, to have a better estimation, wall thickness variability is compared with simpler uniform wall thickness model. In this study Navier-Stokes equations along with elastodynamics equation are coupled through Arbitrary Lagrangian-Eulerian formulation method and solved numerically. Findings demonstrate that the isotropic material model with uniform wall thickness significantly underestimates wall stresses as compared to the anisotropic material model with variable wall thickness. Indeed, results emphasize that considering vessel wall as an anisotropic, heterogeneous (variable thickness) structure estimates much higher wall stresses comparing with isotropic, uniform thickness model. Therefore, given realistic vessel wall structure and the fact that the anisotropic, variable wall thickness model predicts higher wall stresses, it could be a more reliable model to give an accurate estimation to physicians to diagnose the stage of a disease and choosing an appropriate therapeutic procedure.

کلمات کلیدی:

Abdominal aortic aneurysm, Fluid, structure interaction, Material model, Wall thickness

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