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Effect of Turbulence on the Temporal Variation of Hemodynamic Stresses in Aneurysm Model under Resting and Exercise Conditions
KHALIL KHANAFER, RAMON BERGUER, JOSEPH BULL, The University of Michigan — A numerical model is developed to analyze pulsatile turbulent flow in axisymmetric abdominal aortic aneurysm models (AAM) using realistic physiological resting and exercise waveforms. The transport equations are solved using the finite element formulation based on the Galerkin method of weighted residuals. The $\kappa - \varepsilon$ model is used in this work to simulate turbulence characteristics of the convective flow by incorporating Boussinesq eddy-viscosity model. A number of interesting features of the flow field resulting from using realistic physiological waveforms are obtained for various pertinent parameters. Such parameters include Reynolds number, size of aneurysm, flexibility of aneurysm's wall, and the propagation of pressure and flow waves through AAM. The effect of non-Newtonian behavior of blood on hemodynamic stresses and compared with Newtonian behavior through AAM is investigated in the present study. The results of the present work illustrate that maximum turbulent shear stress occurs at the distal end of the AAA model. Furthermore, turbulence is found to have a significant effect on the pressure distribution along AAA wall for both physiological waveforms. This work paves the road for researchers in the area of AAA risk rupture to improve their understanding on the mechanics of aneurysm rupture enhanced by increased flow turbulence.

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