Influence of Non-Newtonian Blood Viscosity on Wall Pressure in Right Coronary Arteries with Serial Stenoses

B. Liu[1]

[1]Monmouth University, West Long Branch, NJ, USA

Abstract

Objectives: The objectives of the present work are to study the blood flows in patient specific right coronary arteries with serial stenoses and to investigate the effect of the non-Newtonian blood viscosity on the local wall pressure, the pressure drop coefficient and the magnitude of the local spatial gradient of wall pressure.

Methods: 3D mathematical models are developed to simulate the blood flows in stenotic right coronary arteries. The geometry of the artery is reconstructed based on the lumen contour curves extracted from a dataset of in-vivo 3D IVUS slices. Simulations are carried out with various flow parameters under physiological conditions, and the computations are performed using COMSOL Multiphysics® software. Numerical results obtained from the Newtonian model and the non-Newtonian models obeying the Power Law and the Carreau model are compared and analyzed.

Results: The blood flow in human right coronary arteries with serial stenoses is complex. The wall pressure, the pressure drop coefficient and the wall pressure gradient change markedly on the lumen surface. The non-Newtonian viscosity of blood does not have a significant effect on the time averaged wall pressure and pressure drop coefficient.

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Figures used in the abstract

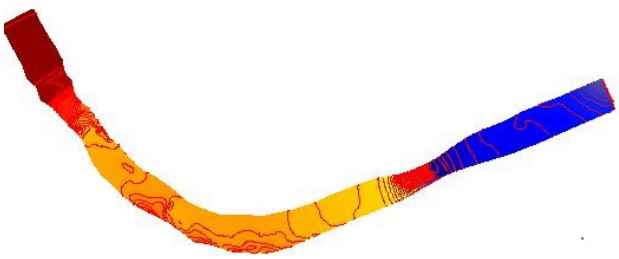

Figure 1: Contour of wall pressure at peak flow rate.