Generalized Power Law Model of 3D Blood Flow in Bifurcated Stenosed Artery

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Abstract

Stenosis is a localize plaque that cause the vessel wall narrowed and causing an alternation in the flow structure which consequently reduced the fluid flow passing to the other organs and tissues. Previous researchers had proven that the formation of stenosis could disturb the normal hemodynamics in blood rheology. Generalized power law model is the best model describing a narrowing blood artery which cause by the present of stenosis in the artery. This study considered the geometry of the bifurcated artery in the presence of single mild stenosis in the parent artery following S. Chakravarty and P.K. Mandal (1997). Furthermore, the blood vessel is modelled as a three-dimensional (3D) rigid wall since the wall of a diseased artery is reported to be less compliant and the blood flow is assumed to be incompressible, laminar, and unsteady by considering physics interfaces such as laminar flow. Numerical results are obtained using COMSOL Multiphysics 5.2 that based on finite element method (FEM). Results concerning the severity of stenosis produces a considerable effect on the blood flow characteristics such as the velocity profiles, the streamlines patterns and variation of wall shear stress, and these results are carefully observed and explained.

Figures used in the abstract

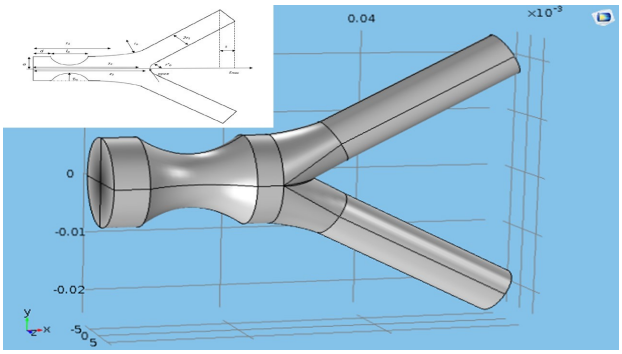

Figure 1: The three dimensional geometry of bifurcated stenosed artery is constructed using the same mathematical equations as given by S. Chakravarty and P.K. Mandal (1997).