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PII: S0021-9290(17)30520-1
DOI: https://doi.org/10.1016/j.jbiomech.2017.09.042
Reference: BM 8406

To appear in: *Journal of Biomechanics*

Accepted Date: 25 September 2017

Please cite this article as: M. Iasiello, K. Vafai, A. Andreozzi, N. Bianco, Analysis of non-Newtonian effects within an aorta-iliac bifurcation region, *Journal of Biomechanics* (2017), doi: https://doi.org/10.1016/j.jbiomech.2017.09.042

Analysis of non-Newtonian effects within an aorta-iliac bifurcation region

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Abstract. The geometry of the arteries at or near arterial bifurcation influences the blood flow field, which is an important factor affecting arteriogenesis. The blood can act sometimes as a non-Newtonian fluid. However, many studies have argued that for large and medium arteries, the blood flow can be considered to be Newtonian. In this work a comprehensive investigation of non-Newtonian effects on the blood fluid dynamic behavior in an aorta-iliac bifurcation is presented. The aorta-iliac geometry is reconstructed with references to the values reported in Shah et al. (1978); the 3D geometrical model consists of three filleted cylinders of different diameters. Governing equations with the appropriate boundary conditions are solved with a finite-element code. Different rheological models are used for the blood flow through the lumen and detailed comparisons are presented for the aorta-iliac bifurcation. Results are presented in terms of the velocity profiles in the bifurcation zone and Wall Shear Stress (WSS) for different sides of the bifurcation both for a male and female geometries, showing that the Newtonian fluid assumption can be made without any particular loss in terms of accuracy with respect to the other more complex rheological models.

Keywords: arterial bifurcation, arteriogenesis, non Newtonian, 3D geometrical model, Wall Shear Stress, aorta-iliac bifurcation

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