




Effects of Brownian motions and thermophoresis diffusions on the hematocrit and LDL concentration/diameter of pulsatile non-Newtonian blood in abdominal aortic aneurysm

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Abstract

LDL concentration is believed to be responsible for plaque formation that leads to atherosclerotic cardiovascular disease. We conducted this study to investigate the effects of hematocrits and LDL diameters on LDL concentration on the wall of an abdominal aortic aneurysm (AAA). The blood flow was considered to be a pulsatile and non-Newtonian flow whose viscosity was a function of hematocrits and strain rate. Lumen, Brownian, and thermophoresis diffusions were analyzed in LDL concentration. The results demonstrated that adding thermophoresis diffusion increases LDL concentration. Moreover, among three types of LDLs, including small LDLs, intermediate LDLs, and large LDLs, small LDLs were the ones with the highest concentration at the wall of the aneurysm. Furthermore, the effects of vorticity on diffusions were examined; it could be noted that the maximum Brownian diffusion appeared in vorticity places. Our results indicated that Brownian diffusion declines as hematocrit reaches 45% whereas thermophoresis diffusion increases. The current simulation investigated the effects of hematocrits, vorticity, Brownian, and thermophoresis diffusions on LDL concentration on the wall. Three types of LDL were taken into account for investigation of the effects of the diameter and reference concentration on LDL concentration. The outcomes of this study could be summarized as the following: the maximum amount of the wall shear stress appeared at $0.2T$ and at the upstream end of the AAA; moreover, thermophoresis diffusion increased small LDL concentration by 26% on the wall for hematocrit 45%.