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ORIGINAL ARTICLE

Employing Sisko non-Newtonian model to investigate the thermal behavior of blood flow in a stenosis artery: Effects of heat flux, different severities of stenosis, and different radii of the artery



Abstract :

Abstract In this paper, a numerical investigation is carried out to study the blood flow behavior within the stenosis artery. An artery is under applying a constant heat flux on the boundary walls in this simulation. Lumen model is employed for simulation of the artery and the Sisko model is used to indicate properties of blood as non-Newtonian fluid. Also, the cone geometry of stenosis with different severities and radii are simulated. Then, effects of heat flux, different severities of stenosis, and different radii of the artery are studied on the blood flow behavior. It is reported that before stenosis, velocity is increasing and heat transfer rate is also increasing which cause temperature to be decreased in stenosis position. But after stenosis, velocity is decreased. Consequently, heat transfer rate is decreased which leads to reduction in blood temperature. Also, since the blood particles adhere to the arterial wall, with increasing radial distance from the walls, velocity is increased, which causes maximum velocity to be found in the central region. Moreover, the thermal driving force is damped in the lateral region of the artery and does not affect velocity. On the other side, as the severity increases step by step, the temperature decreases, respectively. In fact, the crosssectional area decreases with increasing severity of stenosis. Consequently, velocity increases and causes heat transfer enhancement, which leads to a reduction in blood temperature. Therefore, the highest temperatures are related to the artery with an intensity of 20%. Although the crosssection area of the artery can change blood temperature, but its role can be ignorable in temperature enhancement and body healthy in this regard