NUMERICAL SIMULATION OF FLOW IN TRIFURCATED LEFT CORONARY ARTERIES

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The aim of this study is to investigate variations of blood flows *in vitro* Left Coronary Arteries (LCA) using numerical approaches. The geometry of LCA comes from Computer Tomography (CT) measurements of 5 patients, so the angles of trifurcation, diameter, and curvature of blood vessels are different. Subsequently, we analyze flow patterns and stress distributions in bifurcate and trifurcate LCA using a finite volume model. We consider blood flows in LCA with various geometric parameters, observe flow patterns and surface stress distributions on the artery walls, and predict possibility of cardiovascular diseases.

In terms of the obtained numerical results, the blood flows smoothly in acceleration of systole and diastole, but flow patterns change seriously in deceleration of diastole. Due to the influence of angles of bifurcation, there are vortices close to the outside walls at Left Anterior Descending (LAD) or Left Circumflex (LCX) entrance. The oscillatory and low shear stress caused by a vortical flow affects the vessel walls. Hence the vessel intima may be injured by variation of stress. As a result, it would become atherosclerotic in LCA. In addition to the influence of trifurcation angle, a Dean flow is observed in the curved part of LCA in deceleration of diastole. It may cause astherosclerosis under this condition. The mass flow rate of blood is proportional to diameter and angle of bifurcation. LRI not only increases pressure loss and oscillatory shear stress in trifurcate area, but also raises the critical angle with vortical effect. Therefore flow patterns of LCA are influenced obviously by LRI.

Keywords: trifurcate, left coronary arteries, left ramus intermediate, shear stress, Dean flow