World Academy of Science, Engineering and Technology
International Journal of Biomedical and Biological Engineering
Vol:13, No:03, 2019

CFD Analysis of the Blood Flow in Left Coronary Bifurcation with Variable Angulation

Authors : Midiya Khademi, Ali Nikoo, Shabnam Rahimnezhad Baghche Jooghi

Abstract : Cardiovascular diseases (CVDs) are the main cause of death globally. Most CVDs can be prevented by avoiding habitual risk factors. Separate from the habitual risk factors, there are some inherent factors in each individual that can increase the risk potential of CVDs. Vessel shapes and geometry are influential factors, having great impact on the blood flow and the hemodynamic behavior of the vessels. In the present study, the influence of bifurcation angle on blood flow characteristics is studied. In order to approach this topic, by simplifying the details of the bifurcation, three models with angles 30°, 45°, and 60° were created, then by using CFD analysis, the response of these models for stable flow and pulsatile flow was studied. In the conducted simulation in order to eliminate the influence of other geometrical factors, only the angle of the bifurcation was changed and other parameters remained constant during the research. Simulations are conducted under dynamic and stable condition. In the stable flow simulation, a steady velocity of 0.17 m/s at the inlet plug was maintained and in dynamic simulations, a typical LAD flow waveform is implemented. The results show that the bifurcation angle has an influence on the maximum speed of the flow. In the stable flow condition, increasing the angle lead to decrease the maximum flow velocity. In the dynamic flow simulations, increasing the bifurcation angle lead to an increase in the maximum velocity. Since blood flow has pulsatile characteristics, using a uniform velocity during the simulations can lead to a discrepancy between the actual results and the calculated results.

Keywords : coronary artery, cardiovascular disease, bifurcation, atherosclerosis, CFD, artery wall shear stress
Conference Title : ICBSE 2019 : International Conference on Biomedical Science and Engineering
Conference Location : London, United Kingdom
Conference Dates : March 14-15, 2019