

Haemodynamics study in subject-specific abdominal aorta with renal bifurcation using CFD - a case study

ABSTRACT

Study of haemodynamics with advances in computational simulation is beneficial in demonstrating the flow dynamics of cardiovascular diseases such as atherosclerosis. Numerical simulation investigation on subject specific models provides detailed information on haemodynamic conditions. In the present study, two separate cases of subject specific abdominal aorta with renal bifurcation is investigated. Both the cases are diagnosed to be normal with any plaque sites. 3D subject-specific CAD models are generated based on CT scan data using MIMICS-16.0 and numerical analysis is performed using Computational Fluid Dynamics (CFD) in ANSYS-17. The blood flow is assumed to be incompressible, homogenous and Newtonian. Flow equations are simulated for three pulse cycles and haemodynamic parameters such as flow pattern, Wall Shear Stress (WSS) and pressure contours are studied at the bifurcation and critical zones. The variation in flow behaviour is investigated throughout the pulse and simulation results obtained demonstrate that there is a considerable flow recirculation in the downstream side of abdominal aorta and distal side of renal branches. The obtained results agree well with the clinical observation and demonstrate the potential of subject-specific numerical studies in prognosis of disease progression.

Keyword: Haemodynamics; Abdominal aorta; Renal artery; Subject-specific modelling