Study of the influence of normal and high blood pressure on normal and stenosed carotid bifurcation using fluid-structure interaction

ABSTRACT

Atherosclerosis (stenosis) is a common cardiovascular disease in which the blood vessel restructures by narrowing, thickening and gets hardened due to the deposition of plaque. A detailed study of narrowing of arteries applying computational aspects which leads to better findings in order to know the underlying mechanics of development and progression of such diseases. Such kind of analysis can be a useful tool for the medical professionals to study the realistic physiological conditions. They can simulate and observe the blood flow in arteries. In the present study, a case of normal and stenosed carotid bifurcation is simulated. The models are generated in CATIA based on the clinical data obtained from a patient using Ultrasound Doppler. A transient FSI analysis considering Newtonian behavior is performed to compare the significance of High Blood Pressure (HBP) and Normal Blood Pressure (NBP) on carotid bifurcation. The FSI simulation is carried out for both HBP and NBP conditions for several pulse cycles on normal and stenosed models using ANSYS13.0 to demonstrate the changes in flow behavior at various sections of the model. The computed results agree well with clinical observations and available literature as seen in case of NBP.

Keyword: Blood flow simulation; Carotid artery; Fluid-Structure Interaction (FSI); High blood pressure