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Synopsis

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Plaque Concentration Modelling and Hemo-Acoustic Study in Axisymmetric Stenosed Coronary Artery

The role of accurate Hemo-dynamic parameter prediction through computational simulations plays an important role in atherosclerotic surgery planning. Early diagnosis of constrictions in arteries through a cost-effective strategy can reduce the sudden deaths due to stroke. The proposed work intends to address above challenges by modelling pulsatile blood flow in constricted coronary arteries using a new solver 'LDLFoam' developed using a base template of 'icoFoam'. The validation of 2D axis-symmetric blood flow model is first carried out using the results of 3D DNS velocity profiles reported by Varghese et al. [1]. The low density lipo-protein (LDL) concentration is calculated by solving a transport equation along with Navier-Stokes equations for blood. After successful validation of N-S model, the transport model is incorporated to study LDL concentration. This model is validated with 3D numerical results presented by Fazli et al. [2]. The correlation between Wall Shear Stress (WSS) and plaque concentration may give a qualitative picture on regions susceptible for growth of further plaque (LDL). The second aspect involves calculation of an engineering parameter using lumen pressure which can indicate murmur/bruits heard on stethoscope for a diseased patient. The pulsatile blood flow in stenosed coronary artery is studied for stenosis of 50, 60, 70 % (by diameter) and L = 1D, 2D, 3D, 4D to analyse LDL concentration variation and acoustic indicator. It is observed that regions where WSS suddenly drops and goes into a small negative zone are more susceptible for plaque growth. Also, as the length of stenosis increases, larger region is found to be more susceptible for plaque growth.

keywords: *Computational Hemo-dynamics, Low Density Lipoprotiens (LDL), Sound spectrum.*

References

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