Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Wall Shear Stress in Aorta with Coarctation and Post-Stenotic Dilatation - Scale Resolved Simulation of Pulsatile Blood Flow ROLAND GARDHAGEN, MATTS KARLSSON, Department of Management and Engineering, Linkoping University — Large eddy simulations of pulsating blood flow in an idealized model of a human aorta with a coarctation and a post-stenotic dilatation were conducted before and after treatment of the stenosis using Ansys Fluent. The aim was to study wall shear stress (WSS), which influences the function of endothelial cells, and turbulence, which may play a role in thrombus formation. Phase average values of WSS before the treatment revealed high shear in the stenosis at peak systole, as expected, but also at the end of the dilatation. In the dilatation backflow causes a negative peak. Diastolic WSS is characterized by low amplitude oscillations, which promotes atherogenesis. Also noticeable is the asymmetric pattern between the inner and outer sides of the vessel caused by the arch upstream of the stenosis. Thus, large spatial, temporal, and probably asymmetric WSS gradients in the already diseased region suggest increased risk for further endothelial dysfunction. This reflects a complex, partly turbulent, flow pattern that may disturb the blood flow in the abdominal aorta. After treatment of the stenosis, but not the dilatation, fluctuations of velocity and WSS were still found, thus harmful flow conditions still exist.

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Date submitted: 03 Aug 2012 Electronic form version 1.4