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Quantitative Assessment of Wall Shear Stress in an Aortic Coarctation – Impact of Virtual Interventions MATTS KARLSSON, MAGNUS ANDERSSON, Depertment of Management and Engineering, Linkoping University, JONAS LANTZ, Department of Science and Technology, Linkoping University — Turbulent and wall impinging blood flow causes abnormal shear forces onto the lumen and may play an important role in the pathogenesis of numerous cardiovascular diseases. In the present study, wall shear stress (WSS) and related flow parameters were studied in a pre-treated aortic coarctation (CoA) as well as after several virtual interventions using computational fluid dynamics (CFD). Patient-specific geometry and flow conditions were derived from magnetic resonance imaging (MRI) data. Finite element analysis was performed to acquire six different dilated CoAs. The unsteady pulsatile flow was resolved by large eddy simulation (LES) including non-Newtonian blood rheology. Pre-intervention, the presence of jet flow wall impingement caused an elevated WSS zone, with a distal region of low and oscillatory WSS. After intervention, cases with a more favorable centralized jet showed reduced high WSS values at the opposed wall. Despite significant turbulence reduction post-treatment, enhanced regions of low and oscillatory WSS were observed for all cases. This numerical method has demonstrated the morphological impact on WSS distribution in an CoA. With the predictability and validation capabilities of a combined CFD/MRI approach, a step towards patient-specific intervention planning is taken.

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