**Numerical analysis of wall shear stress distributions in a realistic cerebral aneurysm with different non-newtonian blood models**


**Abstract.** The rupture risk of cerebral aneurysms depends on the aneurysm wall stress. The wall thickness and the wall properties are influenced by the wall shear stress (WSS) and wall stress. Computational fluid dynamics (CFD) combined with non-invasive imaging methods for geometry assessment can determine intra-aneurysmal flow parameters. In CFD simulation the blood viscosity model got an impact on the WSS. Therefore three non-Newtonian models and the Newtonian approach are used to study their influence on the WSS distributions in anatomically realistic cerebral aneurysm of the basilaris artery. A 68-year-old female with an unruptured basilar tip aneurysm underwent a computed tomography angiography for surgical planning. The image stack consisted of slices of 2 mm thickness with 1 mm distance in a 512×512 pixel matrix or 0.4 mm × 0.4 mm × 1 mm voxel size. Raw data were used for 3D-reconstruction of the aneurysm. Three non-Newtonian models – Casson, Walburn-Schneck and generalized Power Law (GPL) – were fitted on literature data of blood rheology under pulsatile flow conditions. The best fitting was achieved by the GPL model with a Pearson’s correlation coefficient of R=0.998. The Walburn-Schneck and Casson models achieved values of R=0.975 and R=0.899. A reference WSS distribution was determined with the Newtonian viscosity model (3.5 mPas). Three WSS ranges were defined for comparative analysis (low: 0 to 0.4 Pa; mid: 0.4 to 1.5 Pa; high: >1.5 Pa) and the corresponding area percentage of the aneurysm dome were determined. The fitted GPL model shows the best agreement to the experimental data. This difference between the models seems to have an impact to the distribution of wall shear stress in cerebral aneurysms.