

Mathematical Modelling of the Flow in Brain Aneurysms — Challenges and Potential Benefits

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The aneurysm is a local extension of a vessel. The incidence of the brain aneurysm is relatively high but it is dangerous only in the case of rupture when the blood is released into the brain. Using the imaging techniques such as computer tomography angiography and magnetic resonance angiography an aneurysm is often discovered incidentally on the brain artery before rupture. The risk of rupture is relatively small, but it is growing every year. On the second hand preventing surgery can also bring the complications. The need of accurate computation of the velocity and stress fields in patient specific geometries is motivated exactly by the question which aneurysm has tendency to rupture and should be preventively treated.

Even if we consider incompressible newtonian fluid, the problem is quite challenging because of the patient-specific geometries of the vessels and big size of the resulting linear problem. There is also a question about correct boundary conditions and specific hemodynamic parameters responsible for the birth, growth or rupture of the aneurysm.

We will introduce the whole problem of the brain aneurysms and present the current projects of the Department of Neurosurgery at Masaryk Hospital in cooperation with the Mathematical Institute at Charles University.