Abstract Submitted
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Numerical predictions of hemodynamics following surgeries in cerebral aneurysms[1] VITALIY RAYZ, MICHAEL LAWTON, LOIC BOUSSEL, JOSEPH LEACH, GABRIEL ACEVEDO, VAN HALBACH, DAVID SALONER, UC San Francisco — Large cerebral aneurysms present a danger of rupture or brain compression. In some cases, clinicians may attempt to change the pathological hemodynamics in order to inhibit disease progression. This can be achieved by changing the vascular geometry with an open surgery or by deploying a stent-like flow diverter device. Patient-specific CFD models can help evaluate treatment options by predicting flow regions that are likely to become occupied by thrombus (clot) following the procedure. In this study, alternative flow scenarios were modeled for several patients who underwent surgical treatment. Patient-specific geometries and flow boundary conditions were obtained from magnetic resonance angiography and velocimetry data. The Navier-Stokes equations were solved with a finite volume solver Fluent. A porous media approach was used to model flow-diverter devices. The advection-diffusion equation was solved in order to simulate contrast agent transport and the results were used to evaluate flow residence time changes. Thrombus layering was predicted in regions characterized by reduced velocities and shear stresses as well as increased flow residence time. The simulations indicated surgical options that could result in occlusion of vital arteries with thrombus. Numerical results were compared to experimental and clinical MRI data. The results demonstrate that image-based CFD models may help improve the outcome of surgeries in cerebral aneurysms.

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Vitaliy Rayz
UC San Francisco

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