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Validation of Blood Flow Simulations in Intracranial Aneurysms[1]
YUE YU, Brown University, TOMER ANOR, Children's Hospital, HYOUNGSU BAEK, Brown University/MIT, MAHESH JAYARAMAN, Brown University Medical School, JOSEPH MADSEN, Children's Hospital, GEORGE KARNIADAKIS, Brown University — Catheter-based digital subtraction angiography (DSA) is the most accurate diagnostic procedure for investigating vascular anomalies and cerebral blood flow. Here we describe utilization of DSA in a patient with an intracranial aneursysm to validate corresponding spectral element simulations. Subsequently, we examine via visualization the structure of flow in internal carotid arteries laden with three different types of aneurysms: (1) a wide-necked saccular aneurysm, (2) a narrower-necked saccular aneurysm, and (3) a case with two adjacent saccular aneurysms. We have found through high resolution simulations that in cases (1) and (3) in physiological conditions a hydrodynamic instability occurs during the decelerating systolic phase resulting in a high frequency oscillation (20-50 Hz). We use the *in-silico* dye visualization to discriminate among different physical mechanisms causing the instability and contrast their effect with case (2) for which an instability arises only at much higher flowrates.

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