T. Yagi, Y. Qian, M. Hukushima, A. Kamoda, A. Sato, K. Iwasaki, M. Umezu, H. Takao, Y. Murayamo. Characterization of flow dynamics in intracranial cerebral aneurysm using in vitro modeling techniques. Gerontechnology 2008; 7(2):242. The blood flow in intracranial aneurysm is widely believed as one of the primary causes for ruptures and subsequent subarachnoid hemorrhage. Although the occurrence rate of ruptures is only 10 cases per 100,000 persons approximately[1], it has a significant impact on the life since subarachnoid hemorrhage has a devastating mortality rate. In the United States, the number of persons with intracranial aneurysm is currently estimated to reach as much as 10 to 15 millions including the potential[1]. Thus, there is a significant demand in establishing a risk assessment for aneurismal ruptures, but the characterization of flow dynamics between unruptured and ruptured aneurysms is still poorly understood due to a variety of complex vascular geometries. This study aims to characterize the flows among four cases, including one ruptured, using in vitro modeling techniques in an attempt to evaluate the risk of rupture among a large number of patients. **Methods** All intracranial aneurysms occurred in the internal carotid artery: one ruptured and other three unruptured. The ruptured one had a rather smaller size of around 6 mm at the age of 74, while other unruptured ones had the size of around 9, 11, 16 mm at the age of 60, 64, 54, respectively. Their vascular geometries obtained by 3D-DSA technique were reproduced in a patient-specific silicone model by using a lost-wax casting technique, where the mechanical properties were adjusted to match that of human carotid artery. Then, time-resolved PIV (posterior interventricular artery) measurements were carried out in vitro using a transparent blood-analog fluid, where the flow parameters were reproduced to match physiological ones at a mean flow rate of 300 mL and a heart rate of 70 bpm. **Results and discussion** Careful comparison showed that the ruptured case exhibited a strong jet flow of more than 80 cm/s, which persisted from the neck to head in the downstream side of the aneurysm (*Figure 1*), whereas others more likely show a swirling flow pattern as a dominant flow structure. Those differences were undoubtedly caused by their vascular geometries, where the parent vessel of the ruptured case consisted of an uninflected curve in the immediate upstream, whereas the others have a strong twisting geometry in their counterpart. It was suggested that the intraaneurysmal flow dynamics may differ among ruptured and unruptured cases in terms of the dominant flow structure. **Conclusion** The future work will include a parameterization for differentiating the flow between unruptured and ruptured aneurysms.

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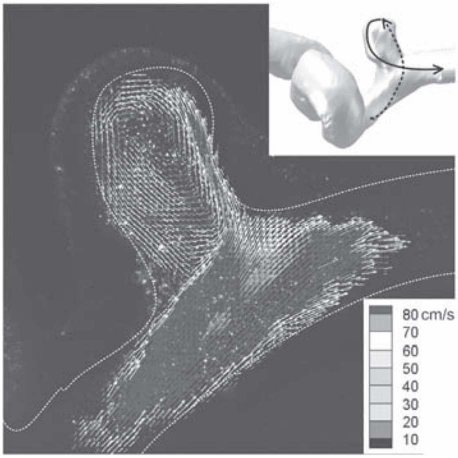

Figure 1 Jet flow observed in the patient-specific model of the ruptured aneurysm. The schema shows the flow pattern through the aneurysm

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