# 学 位 論 文 の 要 旨

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主論文の題名

　Using Computational Fluid Dynamics Analysis to Characterize Local Hemodynamic Features of Middle Cerebral Artery Aneurysm Rupture Points

主論文の要旨

While rupture of cerebral aneurysms typically occurs at the fragile wall at the apex, some aneurysms rupture through the body or the neck. The purpose of this study was to clarify the association between aneurysm rupture points and hemodynamic features through the use of computational fluid dynamics (CFD) analysis.

Twelve ruptured middle cerebral artery aneurysms were analyzed by three-dimensional computed tomographic angiography (3D-CTA) and CFD. Rupture points were evaluated on intraoperative movies. Wall shear stress (WSS) was calculated at the rupture point, aneurysm dome and parent artery. In addition, intra-aneurysmal flow patterns were evaluated with cross-sectional velocity vector planes that included the rupture points.

The mean WSS at the rupture point was 0.29 Pa, which was 12.7% of the WSS at the dome ($P<0.01$). Ten rupture points (83.3%) were located within the area of low WSS. Flow patterns revealed that the rupture point was located around the vortex flow of lower velocity area in 10 aneurysms with complex flow patterns.

This study highlights the relationship between the local hemodynamic features and the rupture points observed during the microsurgical clipping. Our results suggest that the area of low WSS may predict the location of the rupture point of cerebral aneurysms.

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