

Department of Advanced Medicine for Cerebrovascular Diseases

About Us

Stroke is one of the leading causes of death and long-term disability in Japan, a disease in which acute-phase care and advanced technologies directly determine patient outcomes.

The Department of Advanced Medicine for Cerebrovascular Diseases (April 2024 – March 2027) promotes basic and clinical research and education on surgical and endovascular treatment for hemorrhagic and ischemic stroke, with the vision of:

"Delivering safer, higher-quality stroke care from Kyoto to the world."

Under this principle, we pursue clinically driven research and the training of next-generation cerebrovascular surgeons and clinician-scientists.

Key Strengths

- **Acute stroke case accumulation through the Critical Care Center**

In April 2024, our university hospital was designated as a Critical Care Center, leading to a substantial increase in hyperacute cases of subarachnoid hemorrhage and large-vessel occlusion. This rich clinical volume forms the foundation for high-quality real-world data analyses.

- **Hub for comprehensive registries and multicenter collaborative research**

We conduct a multicenter collaborative study on mechanical thrombectomy for acute large-vessel occlusion (UMIN trial ID: UMIN000054214) together with multiple institutions in Kyoto Prefecture. We also lead nationwide analyses using official datasets provided by the Japanese Neurosurgical Database (JND).

- **Advanced application of AI and multimodal imaging analysis**

By integrating time-resolved near-infrared spectroscopy (TD-NIRS), CT perfusion, dual-energy CT, and 3D-SyMRI, we are developing AI-driven intraoperative real-time indicators and novel diagnostic imaging methods.

- **Core training site for the Japan Neurosurgical Society and the Japanese Society for Neuroendovascular Therapy**

Our department serves as a key educational platform for the next generation of stroke specialists and clinical researchers.

Research

Our department conducts a comprehensive research program built on three pillars. Each addresses unmet clinical needs, with the goal of developing novel diagnostic and therapeutic strategies.

A. Internal Carotid Artery Stenosis and Carotid Artery Stenting

■ Detection of liquid atheroma during carotid artery stenting (CAS) and elucidation of its pathophysiology

We perform mass spectrometry analysis of blood retrieved during CAS to detect lipid components such as cholesterol and oxysterols, investigating their pathological and clinical significance. We are also exploring the detection of microplastics and have introduced a novel plaque imaging method using 3D-SyMRI, **bridging clinical practice and basic science as translational research.**

■ AI-based intraoperative prediction of post-CAS hyperperfusion using CT perfusion imaging

We are developing an AI prediction model that integrates preoperative CT perfusion imaging with intraoperative TD-NIRS to predict hyperperfusion syndrome — a serious complication after CAS. Our findings have been presented at the International Stroke Conference and published in peer-reviewed international journals (e.g., *Acta Neurochirurgica*).

B. Acute Large-Vessel Occlusion and Mechanical Thrombectomy

■ Optimization of mechanical thrombectomy based on imaging information

We integrate multimodal imaging information from non-contrast head MRI, CT perfusion, and dual-energy CT to establish more effective and safer indicators for treatment selection and perioperative management. We are also working on detecting microvascular reperfusion failure after thrombectomy using dual-energy CT.

■ Visualization of tissue reperfusion using cerebral oxygenation indicators (multicenter study)

We are conducting a multicenter collaborative study at three institutions in Kyoto Prefecture, evaluating cerebral oxygenation indicators using TD-NIRS before and after mechanical thrombectomy for acute large-vessel occlusion, with the goal of establishing novel peripheral-level tissue perfusion markers (UMIN trial ID: UMIN000054214).

C. Optimal Treatment Strategies for Subarachnoid Hemorrhage (SAH)

■ Establishment of a perioperative management protocol for SAH

We are developing a systemic management protocol for cerebral vasospasm following SAH, and integrating treatment outcomes across multiple affiliated institutions to construct standard management criteria for Japan.

■ Novel approaches to early brain injury in the clazosentan era

As the introduction of clazosentan transforms SAH care, we are exploring diagnostic imaging and therapeutic interventions for early brain injury. Our work includes developing AI prediction models based on Hounsfield unit values from initial head CT, and assessing microcirculatory dysfunction with dual-energy CT and platelet aggregation testing.

■ Optimization of the stroke care network across Kyoto Prefecture

Centered around our hospital's Critical Care Center, we are working in collaboration with administrative authorities to **identify and optimize regional medical infrastructure** — including patient transport systems, surgeon networks, and remote support systems for endovascular therapy. We are also conducting analyses of treatment outcomes before and after the introduction of clazosentan using official JND data.

Collaboration

We welcome collaboration with industry partners, research institutions, and medical organizations.

By leveraging our extensive clinical case volume, multimodal imaging datasets, AI analytics platform, and multicenter research network, we aim to build partnerships that shape the future of stroke care.

Areas of Welcome Collaboration

● Medical Devices and Equipment Development

Stents, mechanical thrombectomy devices, diagnostic imaging systems, intraoperative monitoring equipment (e.g., NIRS)

● Pharmaceutical Research

Therapeutics for vasospasm and early brain injury after SAH, antiplatelet agents, anticoagulants

● AI and Imaging Analytics Platforms

Construction and validation of machine learning models for stroke care, real-time intraoperative AI support

- **Clinical and Multicenter Research**

Prospective observational studies, registry programs, investigator-initiated trials

- **Data Science Collaboration**

Nationwide stroke database analyses, real-world evidence generation

Why Partner With Us

- ◆ **Abundant acute-phase cases at a university hospital with a Critical Care Center**
- ◆ **Strong clinical and educational capacity as a core neurosurgical training site**
- ◆ **Integrated analysis of multimodal imaging (CTP, dual-energy CT, 3D-SyMRI, TD-NIRS)**
- ◆ **Established multicenter research network across Kyoto Prefecture and partnership with public administration**
- ◆ **Track record of presentations at major domestic and international conferences and publications in peer-reviewed journals**

Period & Organization

Department	Department of Advanced Medicine for Cerebrovascular Diseases
Period	April 1, 2024 – March 31, 2027
Department Head	Prof. Naoya Hashimoto (Department of Neurosurgery)
Principal Investigator	Daisuke Maruyama, MD, PhD
Research Theme	Research on cerebrovascular diseases
Affiliated Facilities	Kyoto Prefectural University of Medicine Hospital (Stroke Care Unit / Critical Care Center)

Contact

For inquiries regarding collaborative research, endowed chair partnerships, or research content, please contact us at the following address.

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