

FUNDING PROGRAM FOR NEXT GENERATION WORLD-LEADING RESEARCHERS

Project Title: Development of Non-Invasive and Next-Generation Measurements of Cerebral Blood Flow and Metabolism using Water-Molecule Probe and Phase-Imaging of MRI

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1. Background of research

Brain attack or stroke is a disease in which brain tissue dies due to the occlusion or rupture of cerebral vessels. It accounts for third leading cause of death in Japan. As there are a lot of social problems such as disability, rehabilitation, and nursing care, accurate measurements of cerebral blood flow and oxygen metabolism are needed for adequate prevention and acute management. Among the modalities of cerebral blood flow measurements, PET and SPECT has an advantages of accuracy; however, it has also limitations in availability, radiation exposure, and low spatial resolution. Although CT and MRI can also measure cerebral blood flow, these methods are less accurate compared to PET or SPECT.

2. Research objectives

The purpose of this project is to develop next-generation method of cerebral blood flow and metabolism measurements by using MRI with a novel principle, which does not have any radiation exposure. We aim to achieve high-resolution, highly accurate, and safely repeatable examination.

3. Research characteristics (incl. originality and creativity)

Water-molecule probe made from ^{17}O , which is a naturally-occurring stable isotope, is used as a contrast agent to measure cerebral blood flow. Therefore, safe and highly accurate method of blood flow measurement will be achieved. In addition, phase-imaging of MRI is utilized for the measurement of oxygen metabolism in the brain, and this method is also safe and expected to be highly accurate without radiation exposure. We will try to apply our methods to functional imaging of the brain and try to elucidate unknown pathophysiology of brain disorders, by visualizing functional information in microscopic level through the use of ultra-high resolution of MRI.

4. Anticipated effects and future applications of research

It would be possible to achieve adequate prevention or acute management of brain stroke, to decrease the incidence of disability, and to minimize social costs such as rehabilitation and care. It is also expected to elucidate the pathophysiology of dementia, depression, and other brain disorders. Currently, the refining cost of ^{17}O is very high; however, demonstrating efficacy of ^{17}O as a contrast media will facilitate the development of refining technology in the domestic companies with low cost. Finally, ^{17}O may become a novel molecular agent from Japan.