ANGIOGRAPHIC VISUALIZATION OF PERFORATING BRANCHES OF CEREBRAL ARTERIES TOWARD PATHOPHYSIOLOGICAL EVALUATION OF VASCULAR COGNITIVE IMPAIRMENT

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Purpose: The cerebral white matter disease caused by circulatory disorders of perforating branches of cerebral arteries (PBCA) is frequently associated with vascular cognitive impairment. We developed two microangiographic systems (MANG) to visualize PBCA in basic and clinical settings.
Methods and Materials: The one MANG using monochromatic synchrotron radiation (SR-MANG) with a resolution of 5 μm visualizes arterioles and measures the drug-induced changes in their diameters in small animals. The other MANG using rotating cerium anode and a X-ray source for CT system (Ce-MANG) visualizes small vessels in deep organs in large animals. The both MANGs contains X-ray with an energy of just above K-edge of iodine (33.2 KeV) characterized by substantial difference of mass absorption coefficient between iodine contrast materials and body tissue.
Results: In normal rats (n=11), the SR-MANG with local injection of contrast materials visualized the PBCA and fingertip small vessels with a diameter range of 30-200 μm, and demonstrated the increase in their diameters induced by acetylcholine administration. In diabetic rats (n=35), SR-MANG demonstrated acetylcholine-induced paradoxical decreases in vascular diameters of the PBCA and fingertip small vessels. In the excised organs of the dogs, Ce-MANG visualized PBCA and the intramural branches of coronary artery (diameter range of 80-500μm). These small vessels could be also visualized even through acrylic plate of 20 cm thickness, which simulated X-ray attenuation of human body.
Conclusion: The SR- and Ce-MANGs will lead to better understanding of cerebral white matter disease-related cognitive impairment both in basic and clinical settings.