Future Aspect of Functional Imaging

1-i

FUNCTIONAL IMAGING OF THE BRAIN.
Fumio Shishido. Research Institute for Brain and Blood Vessels-Akita, Akita.

Recently, the diagnostic imaging approach of the brain has been converted by the development of various kinds of techniques, such as X-ray computed tomography, digital subtraction angiograpy, nuclear magnetic resonance imaging, and emission computed tomography. Nuclear medicine techniques are increasingly used in the diagnosis of the brain, and they are mainly required in physiologic and biochemical information to relate anatomic structure, which is so-called "functional imaging". Measurement of regional cerebral circulation and energy metabolism are now used in clinical conditions such as; cerebrovascular disease, brain tumor, degenerative diseases, epilepsy, and so on. Neurotransmitter and its receptor mapping are also investigated recently in some institutes.

One of the largest contribution of emission computed tomography to brain is cerebrovascular disease. Using positron emission tomography (PET), the relationship between blood flow and energy metabolism has been evaluated in ischemic conditions of the brain. The ischemic thresholds, relationship between blood supply and demand of energy metabolism substrates, and remote effects of ischemic lesions were investigated. Single photon emission tomography (SPECT) is not measured oxygen metabolism, but PET studies have clarified that CBV/CBF ratio has good correlation with oxygen extraction fraction using SPECT. CBV/CBF ratio may be useful parameter for cerebrovascular disease.

PET studies in brain tumor have concentrated on measuring metabolism of oxygen, glucose, amino acids, and nuclear acids. Glucose metabolism in brain tumor has been studied. A correlation between grade of glioma and glucose metabolism has been reported, and measurement of glucose metabolism can make distinction between recurrence of glioma and radiation necrosis in the brain which is difficult to make differential diagnosis on clinical and X-ray CT evidence. Other use of tomographic functional imaging in brain is for the research of human brain function. We have investigated the function of visual cortex. Nuclear medicine technique can be an important role in such research work.

Thus, emission tomographic procedures of the brain will play an increasingly important role not only in the diagnosis and management of patients with neurological diseases but also in the research tool for human beings, and the method will produce unique results which cannot be obtained by other techniques.

1-ii

QUANTITATIVE MEASUREMENT AND FUNCTIONAL IMAGING OF BRAIN.
TAKASHI ITOH (NIPPON MEDICAL SCHOOL,TOKYO)
TOSHIROU YAMASAKI (N.I.R.S, CHIBA)

By the investigation of synthesizing of positron emitting radionuclide, in these years, the ability of PET for the measurement of central nerve system are evaluating. According to this evaluation, the importance of the quantitative measurement are increasing. Wagner and his groups were already measured the number of D2 dopamine receptor in living human brain , and their result supported the dopamine hypothesis. In our institute, using 11C-Ro15-1788, we started the quantitative study for the binding affinity of Benzodiazepine receptor in vivo human brain.

The most important point for the quantitative measurement of brain function by PET in vivo is the kinetics model of positron tracer. The model must be based on the physiological facts, and also it must be solved. Too complicated model could not be solved with high reliability. So, the models were often simplified. There are two methods to estimate the model, the explicit method and the operationally simplified ratio method.

The selection of the kinetic model and the method must be based on the features of tracer in vivo living human brain and performance of PET. We explain the selection of the model and estimation method for 11C-Ro15-1788, and report it's quantitative results and functional image.