88

Division of Neurosurgery, Institute of Brain Diseases, *Cyclotron RT Center, Tohoku Univ. Sendai.

We have investigated the uptake of F-18-fluorodeoxyuridine (FDURd) and F-18-fluorouracil (FUra) in the experimental rat brain tumor (rat glioma C6) by autoradiography and the direct tissue counting technique. The clear brain tumor images were obtained in both cases, however, the brain tumor image looked clearer in the FDURd cases rather than FUra cases. Also the tissue counting reveals that the uptake of FDURd in the brain tumor was higher than that of FUra with statistically significant difference.

The autoradiographic technique using positron emitting radionuclide tracer has following characteristics: prompt result with fine resolution can be obtained, applicable to small animal experiment and the result can be applied directly to the analysis of positron CT data because it has the same theoretical background with positron CT and uses the same tracers.

Our result indicates that F-18-FDURd would be more useful for the clinical application to the positron CT study of brain tumor patients.

89


Recently Phelps et al. (UCLA) has developed a method for analyzing local cerebral metabolic rate of glucose (LCMRGlc) using positron CT. They calculated LCMRGlc from equilibrium distribution of 18-F-FDG and their method has become a standard technique. But it has two problems, one of which is necessity of Op(t), that is time-function of FDG concentration in artery. The other problem is using the normal values of rate constants, which results significant errors in low metabolic state like ischemia. We proposed a new method which analyzed LCMRGlc from time variation of FDG distribution after injection. With our method it is not necessary to use normal rate constants and Op(t). We analyzed a normal case with the UCLA method and the present method, and obtained a very good agreement of the both LCMRGlc's. They have a linear relationship with the coefficient of correlation = 0.99. With the UCLA method LCMRGlc is 5.31 for the average value of gray matter and 3.90 for white matter. With the present method LCMRGlc's are 5.36 and 3.72 for gray and white matter, respectively.

90

MEASUREMENT OF REGIONAL CEREBRAL BLOOD FLOW, OXYGEN AND GLUCOSE UTILIZATION RATE IN PATIENTS WITH CEREBRAL GLIOMA AND STROKE USING 15O-15O2, O2 AND F-18 FLUORODEOXYGLUCOSE AND POSITRON EMISSION TOMOGRAPHY. J. Hatazawa, T. Matsuzawa, Tohoku Univ. School of Medicine, Sendai C. G. Rhodes, R. S. Wise and T. Jones MRC Cyclotron Unit Hammersmith Hospital London UK.

Recent development of positron emission tomography allows the accurate regional measurement of positron emitting isotopes like oxygen-15 CO2 and O2, fluorine-18 fluoro-deoxy-glucose(FDG) of which metabolism are well known biochemically.

Measurement of regional cerebral blood flow (rCBF), oxygen extraction(rER02) and the rate of oxygen utilization(rCMRO2) were obtained using ECAT and the steady state oxygen-15 inhalation technique of CO2 for rCBF and of O2 for rER02 and rCMRO2.

The rate of glucose utilization(rCMRGluc) was measured using ECAT, 18FDG and the equation originally developed by Sokoloff.

In patient with cerebral glioma, the mismatching between oxygen and glucose utilization, that is marked decrease of rER02 and rCMRO2, and high values of rCMRGluc equal to gray matter, was observed.

In patient with early cerebral stroke, rCBF in the lesion was markedly decreased with low rER02 which resulted in diminished rCMRO2. The values of rCMRGluc in the same region was less decreased than that of rCMRO2.

We conclude from these preliminary studies that anaerobic glucose metabolism exist in both cerebral glioma and early stroke.