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ANALYSIS OF REGIONAL CEREBRAL BLOOD FLOW AND OXYGEN UTILIZATION OF PERITUMORAL AREA USING PET IN PATIENTS WITH CEREBRAL TUMORS — ESPECIALLY, CORRELATION WITH HISTOLOGICAL AND X-RAY CT FINDINGS—

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We studied 25 patients with cerebral tumors by means of PET in Oxygen-15 steady state technique, and measured regional CBF and CMRO2 in peritumoral white and gray matter. From view points of histological findings, we classified patients into two groups. One is extra axial tumor (= Group E, 10 patients: all are meningioma), and the other is intra axial tumor (= Group I, 15 patients: 11 glioma, 4 metastatic tumor). And then we examined patients whether they have peritumoral LDA or not on X-ray CT.

Results. The following numerals in parenthesis represents CBF (the former) and CMRO2 (the latter), both unit is ml/min/100g.

Peritumoral white matter... Group E, LDA(+) (18.1, 2.2), L(-) (26.2, 2.2) Group I, L(+) (14.1, 2.1), L(-) (20.2, 0.8).

And then we examined patients whether they have peritumoral LDA or not on X-ray CT.

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Kinetics of carbon-11 labeled N-methyl, 4-methyl benzylamine in human brain.

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Consideration of the central role of amines in brain function makes it appear likely that most of the pathological states of the brain manifest themselves as abnormalities in neuroehemeral amine metabolism or kinetics. The unique ability of tracer materials to assess biochemical kinetics in vivo suggests a major role for labeled amines in the study of normal and altered brain function.

Carbon-11 labeled N-methyl, 4-methyl benzylamine (MMBA) was developed for the study of the kinetics of amines, especially the permeability and the binding sites of amines in the brain. In the mouse brain, the high uptake and rapid wash-out of 11C-MMBA was observed. The kinetics of 11C-MMBA in the human brain was studied with PET. The high uptake 11C activity was observed following i.v. injection of 11C-MMBA. No "wash-out" of 11C activity was observed in some subjects, while 11C activity was gradually cleared in some subjects. The result suggests that the binding potential is different between normal subjects or changing according to the subject's condition.

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Regional cerebral oxygen extraction fraction (OEF) and regional cerebral oxygen utilization (CMRO2) can be measured using autoradiographic and dynamic methods with 15O2 single inhalation and PET, we examined the quantification of these methods by simulation and clinical studies.

In simulation study, we have found that the underestimation of about 10 % in CMRO2 and the more PET scan duration is long, the more the relationship between tissue activity and CMRO2 value becomes inferior in linearity. In clinical study, CMRO2 values of autoradiographic and steady state measurements were related comparatively. However, dynamic CMRO2 resulted in the higher values than that of steady state.

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Physiological reactivity of cerebral blood volume (CBV) to PaCO2 change using 11C inhalation method and PET was measured. Twenty one mm-Hg scans were started at five minutes after 50 mCi 11C inhalation. Arterial blood was sampled every min. In each image 0.3 to 0.9 x 106 counts were obtained. During the scan PaCO2 was changed by CO2 inhalation and hyperventilation. The preliminary studies revealed a relationship between CBV and PaCO2 in the whole cerebrum; CBV = 0.065 x CBV + 1.19. The accuracy of this measurement was examined from three aspects. The anatomical adjustment was shown to be extremely important to obtain a net CBV of brain parenchyma because most of blood volume was in the extracerebral superficial veins. The statistical noise under the present condition was evaluated as 5 % COV with the size of a region of interest of 4 cm diam. The physiological decay of the 11C-RBC was found not to be negligible in the present activation study. The half-life of the physiological decay showed a positive correlation with the hematocrit.