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VARIATION OF REGIONAL CEREBRAL BLOOD FLOW BY FLUCTUATION OF CROSS CALIBRATION FACTORS AND ARTERIAL BLOOD ACTIVITY.

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Regional cerebral blood flow(CBF) can be measured using positron emission computed tomography(PCT) and the continues inhalation of C]5O2. However, there are many error factors in this technique. Therefore, It must be very carefully to evaluate the PCT data. There are to supply positron emitter from cyclotron constantly, to keep steady state of activity in the brain, to do measurement of cross calibration factors and the arterial blood with accurately, to be measured PCT images with precision. It is also necessary to make an effort for minimized errors.

It is done the arterial blood sampling of two times during the measurement of PCT images. The deviation of the sampled arterial blood activity are 4.3%, 6.2% and 5.8% for CO2, O2 and O2-plasma, respectively. After corrected the blood activity with blood weight, the deviation is improved].7%, 3.7% and 2.2% for CO2, O2 and O2-plasma, respectively. It have to do quality control of using devices and all of about this method. In this report investigated variation of CBF by fluctuation of cross calibration factors and measured arterial blood activity. The CBF values change with fluctuation of arterial blood activity compare with fluctuation of cross calibration factors largely.

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MEASUREMENT MODEL FOR PARTITION COEFFICIENT OF $H_2{}^{15}O$ AND POSITRON EMISSION TOMOGRAPHY.

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Two models for calculation of partition coefficient (p) of H_2O were proposed. The one is a "combined method", which uses a ratio of the image of the $C^{15}O_2$ steady state inhalation method (Bs) to that of the $H_2{}^{15}O$ autoradiographic method (Ba) and each arterial radioactivity (As and Aa). From the table of $\int\{(Aa/As)*k\ \exp(-kt\}dt$ $(k=Ef/p+mp)$ and $\int\{(Ba/Bs)\}dt$, k is determined, then $p=k/(k-mu)*(Bs/As)$ where mu is a decay constant of ^{15}O. The other is a "different accumulation time" method, which uses two flow images, k_1 and k_2, from a single $H_2{}^{15}O$ autoradiographic study but different accumulation time. p is given as $p = \{(k_1-k_2)/k_1\}/\{g_1(k_1)-g_2(k_2)\}$, where g_1 and g_2 are reciprocals of slopes of the integral (I) to k nomogram given as $I = \int\{Aa*k\ \exp(-kt)\}dt$. Either methods resulted in the underestimation of p as 0.5 to 0.6 as a mean value. Main reason of such underestimation seems to be the dipersion in the measured artery curve obtained in $H_2{}^{15}O$ autoradiographic study. After correction for the dispersion p values were increased to 0.8 to 0.9. However, these models seemed to be difficult to apply in routine use due to too low signal-to-noise ratio.

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MEASUREMENT OF REGIONAL CEREBRAL BLOOD FLOW WITH O-15 WATER AND POSITRON EMISSION TOMOGRAPHY.

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Steady-state method with O-15 labeled CO2 gas is widely used for the measurement of regional cerebral blood flow (CBF) but has several disadvantages. Time consuming, high radiation dose, difficulty in keeping constant the arterial blood activity, large errors in high flow regions and large effect of tissue heterogeneity. As a solution to these problems, O-15 water one-shot injection method was developed. Following one-shot intravenous injection of 20mCi of O-15 water, tomographic PET images were obtained as a single scan for 60 or 120 sec, during which serial arterial blood sampling was performed. Using single compartment model, regional blood flow was calculated by the look-up table method. This method was superior than steady-state method especially for a loading test althogh it had several problems. First, manual sampling of the arterial blood limited the sampling interval to at shortest 5 sec and made a possibility of missing the peak. Second, it was unexpectedly difficult to determine the time lag between the brain and the blood activity curves. And last, elongation of the PET scanning time decreased the calculated CBF values.

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CEREBRAL BLOOD FLOW MEASUREMENT WITH O-15 H2O CONTINUOUS INFUSION SYSTEM AND USEFULNESS OF CO2 LOAD IMAGES AND EARLY IMAGES.

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O-15 continuous infusion system was presented. It has many advantages such as low exposure to airway tract, accurate control of infusion volume of radioactivity. With this system, we studied CBF reactivity to PCO2 in 3 normal volunteers, 5 patients with p/o moyamoya disease, 2 patients with TIA and 1 patient with cerebral infarction. For the 1 mmHg increase in PCO2, there is a mean hemispheric increase in CBF of 2.1 ml/min/100cc in normal volunteers. Reduced CBF reactivity to PCO2 change was observed in the area of increased CBV of the patients with p/o moyamoya disease. Early images seemed to be useful for the close representation of CBF images.