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EFFECT OF ARTERIAL BLOOD DISPERSION ON THE MEASUREMENT OF CEREBRAL BLOOD FLOW USING PET AND O-15 WATER. M.Senda, S.Nishizawa, T.Shibata, Y.Yonekura, H.Saji, T.Mukai and K.Torizuka. Kyoto University School of Medicine, Kyoto and Fukui Medical College, Fukui.

In the regional cerebral blood flow (F) measurement using O-15 labeled water and positron emission tomography (PET) - autoradiographic (ARG) method, a wide discrepancy may occur between the time-activity cource in the brachial artery (Ca(t)) and the true input function to the regional brain (Ci(t)) due to the difference in blood dispersion along the arteries from the left ventricle to the respecive peripheral site. A model was developed which described the difference of Ca(t) and Ci(t) with a time constant, T. Following one shot i.v. injection of 20 mCi of O-15 water, a dynamic scan was performed for 128 sec with 16 sec/frame, and the regional F and T were estimated using diffusible tracer model. In a patient with the right internal carotid occlusion, the normally perfused areas showed approx. T=-4 sec (less dispersion than at the brachial artery). In contrast, larger T values were observed in and around the infarcted area possibly because more dispersion occurred in the collateral vessels. This suggested that the PET-ARG method has a tendency to underestimate the regional flow in the diseased area and to overestimate in the normal area.

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AN ACCURATE DETERMINATION OF REGIONAL BRAIN/BLOOD PARTITION COEFFICIENT OF WATER USING DYNAMIC POSITRON EMISSION TOMOGRAPHY: VALIDATION OF KETY-SCHMIDT SINGLE COMPARTMENT MODEL FOR $H_2{}^{15}O$ BASED CBF MEASUREMENT. H.Iida, I.Kanno, S.Miura, M.Murakami, K.Takahashi, A.Inugami, F.Shishido and K.Uemura. Research Institute for Brain & Blood Vessels-AKITA, Akita.

In order to investigate the validity of the $H_2{}^{15}O$ as a CBF tracer, brain/blood partition coefficient (PC) was measured accurately using dynamic PET (HEADTOME-III). The scan sequence consisted of 10 5-sec, 5 15-sec and 5 60-sec scans, total about 7-min. The input function, Ca(t), was obtained by withdrawing the artery blood continuously from radial artery using 0.5 mm diam, tube with 5 ml/min of withdrawal speed. The dispersion occurred in the tube was confirmed to be negligibly small. Using the single compartment tracer kinetic model, CBF(f), PC(p) and relative time difference between artery and tissue curve (Δt) were determined region by region. The obtained PC values were almost consistent with that obtained by another technique, i.e., the ratio of water contents in brain tissue to that in blood. The obtained values did not change over various fitting end time.

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HEMATOCRIT EFFECTS ON $H_2{}^{15}O$-BASED CBF MEASUREMENT EVALUATED BY STEADY STATE AND AUTORADIOGRAPHIC METHODS USING POSITRON EMISSION TOMOGRAPHY. I.Kanno, H.Iida, M.Murakami, S.Miura, K.Takahashi, H.Sasaki, A. Inugami, F.Shishido and K.Uemura. Research Institute for Brain and Blood Vessels-AKITA, Akita.

This paper aims to examine the hematocrit (Hct) effect on $H_2{}^{15}O$-based CBF measurement in the $C^{15}O_2$ inhalation steady state method (SS) and the $H_2{}^{15}O$ autoradiographic method (AR). Serial SS and AR study was performed on four normal men and 17 CVD patients. A partition coefficient (PC) was fixed to 1.0. Hct was measured from arterial blood and ranged from 33.0 to 50.0. CBF (CBFss and CBFar) was obtained from the temporal cortex (TMP) and the centrum semiovale (OVL). Correlation coefficient of these values with Hct were calculated. CBFss and CBFar were slightly and no correlated with Hct, respectively. CBFar/CBFss ratio, however, revealed a significant, negative correlation, and its correlation coefficient was higher in OVL than TMP region. These observations were analyzed from the two aspects of Hct, i.e. partition coefficient and hemorheology. Both of these factors was found to partially contribute to phenomena of the present observations, but do not completely explain them. Further analyses are required.

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ERROR ANALYSIS OF A QUANTITATIVE CEREBRAL BLOOD FLOW MEASUREMENT USING $H_2{}^{15}O$ AUTORADIOGRAPHY AND POSITRON EMISSION TOMOGRAPHY. H.Iida, I.Kanno, S.Miura, M.Murakami, K.Takahashi, A.Inugami, F.Shshido and K.Uemura. Research Institute for Brain & Blood Vessels-AKITA, Akita.

The effect of the inaccuracy of the input function on CBF measured by the $H_2{}^{15}O$ autoradiographic method was investigated. In the $H_2{}^{15}O$ autoradiography, the measured input function includes a larger dispersion than the true input function, as well as the absolute time axis having been already lost. Such dispersion, indispensable in a patient study, was found to produce large errors in calculating CBF, e.g. 5(10) sec of the dispersion time constant caused +15(33) and +10(20)5 % systematic overestimations for the 40- and 60-sec accumulation time, respectively. An analytical correction employing an inverse Laplace transform was applied to clinical CBF studies, and the results were compared with the $C^{15}O_2$ steady-state inhalation CBF study. After the correction for the dispersion, the autoradiographic CBF values were reduced and almost consistent with the steady state values.