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QUANTITATIVE POSITRON CT MEASUREMENT SYSTEM IN RESEARCH INSTITUTE OF BRAIN AND BLOOD VESSELS-AKITA USING CARBONMONOXIDE, WITH OXYGEN-15. F.Shishido,K.Uemura, I.Kanno,S.Miura,M.Murakami,E.Hagami, K.Takahashi and T.Yamaguchi. Research Institute of Brain & Blood Vessels-AKITA, Akita.

A plan of a quantitative positron CT measurement system had been reported at the previous annual meeting of JSNM. This system was begun to work for clinical use in April 1983. We firstly used it to measure regional blood volume, regional blood flow, regional oxygen extraction ratio and oxygen consumption in the patients with early cerebrovascular disease using $C^{15}O$, $C^{15}O_2$ and $^{15}O_2$ gases. These tracers are produced with mini cyclotron and automatic gas production unit, and are administered by inhalation in the order, $C^{15}O_2$, $^{15}O_2$, $C^{15}O$. In order to sample arterial blood at each scan, a cannula is inserted in radial artery. The blood is measured hemoglobin content, radioactivity, pH, oxygen tension and carbondioxide tension. These measurements are controlled by micro-computer (MZ-80). After data correction, the data are transfered on line to mini-computer associated with Headtome-III for calculation of the physiological factors. Owing to this system the errors of its half life correction and man-power required to PCT study are decreased. We report in this paper the advantages and problems of this system for clinical use.

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REGIONAL CEREBRAL BLOOD FLOW MEASURED BY $C^{15}O_2$ STEADY STATE MODEL AND ANALYSIS OF THE ERRORS. I.Kanno,K.Uemura,S.Miura, F.Shishido,E.Hagami,H.Sasaki,M.Murakami and K.Takahashi. Research Institute of Brain & Blood Vessels-AKITA, Akita.

The method for the regional cerebral blood flow (CBF) is desired to be shorten enough to detect changes against the various functional activations to the brain. The kinetics of radioactivity following the $C^{15}O_2$ single breath were measured both in the brain by the positron emission tomograph (PET) and in the arterial blood withdrawn continuously by means of the beta-ray detector. Given the kinetics curve of the arterial concentrations of the radioactivity, the tissue concentrations can predict by the convolution integral of the curve and the tissue unit response curve for a given clearance rate. Following the "early picture" method of the reference table look up approach (Kanno-Lassen), regional CBF was absolutely determined from the first one minute PET image. This method was, however, revealed to overestimate CBF relatively to the steady state method. Several factors of this difference such as the assumption of the partition coefficient, the limited permeability, the contamination of the artery and some technical problems were discussed.

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A EVALUATION OF SOME FACTORS AFFECTING THE MEASUREMENT OF rCBF, rOER AND $rCMRO_2$ IN ^{15}O STEADY STATE MODEL. T.Yamaguchi, I.Kanno, K.Uemura,F.Shishido and M.Murakami. Research Institute of Brain and Blood Vessels-AKITA, Akita.

Positron emission tomography (PET), regional cerebral blood flow (rCBF), regional oxygen extraction rate (rOER) and regional cerebral metabolic rate of oxygen ($rCMRO_2$) were measured with using ^{15}O steady state model carried out by continuous inhalation of $C^{15}O$ and ^{15}O. There are various kinds of factors affecting the measurement and calculation of these parameters. In the measurement system itself, they are the quantitativeness of the PET, the linearity of the cross calibration between the PET and the well counter, and the steadiness of radioactive gas supply. In practical study, other factors should also be considered. Even in continuous inhalation of radioactive gas with constant concentration, the time required for the brain activity to reach the steady state, the activity of the arterial blood sampled peripherally and the brain activity detected by the PET can vary. These changes cause some errors in the calculated value of rCBF, rOER and $rCMRO_2$. The correction due to regional cerebral blood volume should be considered, too.

In this study, the significance of the error and correction was evaluated for several normal volunteers using Headtome III as a PET system.

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QUANTITATIVE MEASUREMENT OF REGIONAL CEREBRAL BLOOD VOLUME USING CARBON-11 CO AND POSITRON CT. J.Hatazawa,M.Ito, h.Fukuda,Y.Abe,S.Yoshioka,K.Kubota,K. Ito,T.Matsuzawa, Dept.of Radiol.&Nucl Med,The Res.Inst.for TB & cancer. T.Ido, The Cyclotron & R.I. Center, Tohoku University,Sendai.

Regional cerebral blood volume(rCBV) of young adults (n=4,meanage=29y.o.) and aged (n=3, mean age=67y.o.) was studied by means of C-11 CO inhalation methods and ECAT II. Tissue distribution of C-11 CO was obtained tomographically and sampling of venous blood was carried out. Radioactivity of the blood per plane was measured and crosscalibrated to ECAT device.According to the equation, $rCBV = Ci/Cb \cdot 0.85 \cdot d$; Ci,tissue activity,Cb,blood activity,0.85,hematocrit correction,d,tissue density, images of rCBV were obtained.
All the subjects had brain scanning of X-ray CT and volume ratio of brain matter to cranial cavity at the level of OM + 50 mm.At the same level of rCBV images,ROI was set just on the skull which is superimposed on CRT using Xray-CT pictures. Mean values of rCBV at this level was 4.2 + 0.5 % for young adults and 3.3 + 0.3 % for aged subjects. After the correction for brain volume,these values changed to 4.3 % for young adults and 3.7 % for aged.