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EVALUATION AND CORRECTION OF COUNT RATE CHARACTERISTICS OF POSITOLOGICA-II: A WHOLE BODY POSITRON EMISSION TOMOGRAPH. M.Endo, T.A.Iinuma, H.Shinoto, K.Yoshida, T.Himi, A.Kagaya, S.Inoue and A.Ogushi. National Institute of Radiological Sciences, Chiba University School of Medicine and Hitachi Medical Corporation, Chiba and Tokyo

In order to establish positron emission tomography as a quantitative method, we evaluated count rate characteristics of POSITOLOGICA-II using three phantoms; a) a lucite cylinder 5cm inner diameter and 22cm long filled with water, b) a lucite cylinder 20cm inner diameter and c) a chest phantom. The results were as follows. 1) Total coincidence rate (sum of coincidence event rates from on time and delayed windows) was a constant (660kcps) for very high activity concentrations. 2) Below those concentrations count losses increased with the activity concentration. Although the relationship between count losses and true coincidence rate depended strongly on the phantom configurations, its relationship to single count rate was independent on the phantoms. The result 1) was because the maximum data transfer rate was limited by a rotating photo-coupler employed in the system, and it cannot be corrected. The result 2) was from count losses of single detection and can be corrected by an experimental calibration curve (correction factor vs. single rate) independent of object configurations.

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FACTORS TO DEGRADE QUANTITATION IN POSITRON EMISSION TOMOGRAPHY IN CARDIAC STUDY. Y.Shoji, I.Kanno, Y.Aizawa, T.Hachiya, E.Hagami, S.Miura, M.Murakami, H.Iida, F.Shishido and K.Uemura. Research Institute for Brain & Blood Vessels-AKITA, Akita.

Quantitation of myocardium positron emission tomographic (PET) study suffers a number of factors occurring in the subject side during the measurement. These factors are examined based on phantom experiments and simulation. Misadjustment of re-positioning between the transmission scan and the emission scan was evaluated using the phantom, and resulted in 10 % error at maximum by 2 cm mis-positioning. Partial volume effects were evaluated from the results of experiments using a hot spot phantom. For the 10 mm thick myocardium, 45 % underestimation of PET value was evaluated in the transaxial and the axial direction. Myocardial wall motion and respiratory motions were examined by moving uniformly 10 mm and 20 mm span along the axial direction, and resulted in another 7 % and 23 % underestimation, respectively. Effect of attenuation of the arms when the subject laid with the arms in the fields of view of PET, was calculated by assuming a double of 8 cm water cylinders, corresponding to two arms, to attenuate 511 KeV γ -ray upto 24 %. This implies that four times longer scan time is necessary to obtain the same signal-to-noise ratio.

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DEVELOPMENT OF CARDIAC GATED POSITRON EMISSION TOMOGRAPHY WITH POSITOLOGICA-II. - SPECIFICATION AND PHYSICAL CHARACTERISTICS M.Endo, T.Matsumoto, T.A.Iinuma, H.Shinoto, T.Yamasaki, Y.Tateno, T.Himi, A.Kagaya, K.Yoshida, S.Inoue and A.Ogushi. National Institute of Radiological Sciences, Chiba University School of Medicine and Hitachi Medical Corporation, Chiba and Tokyo

In the PET study of heart quality and quantitiveness of PET images are made significantly worse by blurring due to cardiac motion. In order to avoid motion blurring we developed cardiac gated PET in which coincidence events were collected by a positron emission tomograph (POSITOLOGICA-II) with gating from electrocardiography. In the present method data at two cardiac phases (endsystole and enddiastole for example) are collected, accumulated during predetermined heart cycles and then reconstructed. Delay time from triggered R-pulse can be varied 0-999msec and data sampling time can be varied 10-999msec. Physical characteristics of the present method were measured with a phantom, which consisted of a rotating positron source and provided gating signals. The results satisfied design specifications.

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DEVELOPMENT OF ELECTROCARDIOGRAPHIC GATED POSITRON EMISSION TOMOGRAPHY WITH POSITOLOGICA-II: MERITS IN CLINICAL USE. T.Himi, A.Kagaya, K.Yoshida, N.Morooka, S.Watanabe, Y.Masuda, Y.Inagaki, M.Endo, T.Iinuma, T.Yamazaki and Y.Tateno. The Third Department of Internal Medicine, Chiba University School of Medicine and National Institute of Radiological Sciences

We performed electrocardiographic gating in positron emission computed tomography with POSITOLOGICA-II. We obtained end-systolic and end-diastolic images from 10-15 minuits after injection of N-13 ammonia and 600-750 heart beats were required with 50 msec duration of sampling-time each. From these images we found that 1) end-systolic and end-diastolic image indicated those morphological character of each phase. 2) Because of partial volume effect, maximal counts of the images of end-systolic phase were higher than those of end-diastolic phase. 3) The counts of left ventricular blood pool at end-systolic phase were higher than those of end-diastolic phase.

This program was thought to be useful at steady-state study, but at dynamic study it may take too long time.