LFOV gamma camera, Ventil-con and mini-computer (Scintipac 200) were used. Ninety frames of lung images after inhalation of ^{133}Xe gas were obtained with 5 seconds interval by use of scintipac 200. The image consists of 64 × 64 pixcel.

We supposed that ^{133}Xe gas concentration in the lung during washout was proportional to the first term of the following equation; $I=I_0 \exp(-Kt)+B$, where B is background count, I_0 initial count, t time elapsed and K constant. K and B were obtained by use of the successive approximation with the least square method. Initial value K was obtained using several frames of initial washout and approximate formula, $\exp(-Kt)=1-Kt$. Counts of the last frame was used for B. The number of iteration was usually about 10. Six ROI's were set in both lung fields and mean transit time, which were reciprocal of K were calculated in each ROI by use of BICOM.

Since BICOM is built-in language of scintipac 200 and based on BASIC language, programming and operation of the data processing were very easy. Clinical usefulness of regional mean transit time will be reported elsewhere.

Gamma Camera Imaging of Closing Phenomenon in the Lung

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Closing phenomenon is known to be an expression of small airway closure at the state of low transpulmonary pressure and thought to be a sensitive means for early pathophysiological changes of the small airway. Since this phenomenon has never been materialized so far, we attempted to visualized it using radioactive gas and gamma camera, and compared it with the conventional resident gas method.

Ten normal volunteer with or without a history of smoking habit and eight patients with a variety of cardiopulmonary disease were investigated. A bolus of ^{81m}Kr or ^{133}Xe gas as a marker gas was inhaled at the level of reserve volume with the subsequent slow maximum inspiration, the image of inspiration distribution was recorded by the gamma camera and stored into the storage system for further analysis. This image was compared with the image of volume distribution of the radioactive gas which was obtained by the recording of the equibrated state at the level of maximum inspiration within a closed circuit during rebreathing.

In the case of smoker as well as of the patients with interstitial edema, closing phenomenon were observed as inspiratory defect at the dependent lower lung region with a horizontal demarcation. The level of this boundary was well correlated with the closing capacity measured by the conventional resident gas method. The radioactivity value was converted into volume value by a digital computer, and this estimated value was better correlated with the closing capacity ($r=0.947$, $p<0.005$). In the case with other diseases such as chronic obstructive pulmonary disease and lung fibrosis, closing phenomenon was expressed in a form of a exaggerated defect at diseased region.

Studies on the Mechanism of the Phase IV in a Single N_2 Method by Using ^{81m}Kr

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The phase IV in a single breath N_2 washout has been well recognized to be useful for early detection of small airway disease. In this paper the mechanism of the phase IV was studied by ^{81m}Kr.

About 5-8 millicuries in 20m*l* of ^{81m}Kr were rapidly administered in the mouthpiece. Subjects were instructed to inhale ^{81m}Kr from different lung volumes in a sitting position. ^{81m}Kr counts were always measured at the same position (FRC+2,000 m*l*) with a scinti camera. Each lung was horizontally divided into 6 regions. The regional counts over the total counts of ^{81m}Kr (the divided coefficient) were calculated. The regional volumes at FRC+2,000 m*l* and at RV were obtained by the attainment equilibrium in a closed circuit by using ^{133}Xe. The values of the divided coefficient corrected by the lung volume at FRC+2,000 m*l* became smaller as lung volume increased from RV to closing volume.

Then closing volume was approximately equal to the lung volume at which the value of the divided coefficient was the smallest.

The changes in regional lung volume were bigger in the upper than in the lower lung regions at the lung volumes from RV to closing volume and the relationship between regional lung volumes and summation of each regional lung volume was curvilinea.

The washout curve of a single breath N_2 method was compared with the curve simulated by the data obtained by ^{81m}Kr. Both curves were found to be same.

The Characteristic Distribution of Pulmonary Perfusion and Ventrilation to the Dependent and Upper Lung in Lateral Decubitus Position

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The effect of the gravity on the pulmonary perfusion and ventilation in lateral decubitus position were reported to be shifted to the dependent lung. However, we found cases whose ventilation was not shifted to the dependent lung in the left lateral decubitus. Therefore, the purpose of the present study was to further analyze the effect of decubitu positions on the ventilation and perfusion of the lung.

Materials and Methods: Seven normal subjects were examined in this study using ^{81m}Kr and ^{133}Xe. The distribution of ventilation in tidal breathing was examined with continuous oxygen flow. The perfusion was detected by continuous I.V. injection of glucose solution of ^{81m}Kr. Ventilation was also examined by single breath and wash out of ^{133}Xe gas. Perfusion was further evaluated by I.V. injection of ^{133}Xe solution.

Results and Conclusions: In ^{81m}Kr study, mean values of percentile distribution of perfusion in right and left lung by supine position were 55.9 and 44.1%, respectively. In right decubitus position, mean values of perfusion in the dependent lung and upper lung were 67.6 and 32.4% respectively. Those values of the depedent and upper lung in left decubitus were 56.7 and 43.3%, and the shift of perfusion to the dependent lung was observed in this position as well as in right decubitus. On the other hand, mean values of ventilation of right and left lung in supine position were 57.7 and 42.3% respectively, and the similar distribution of ventilation was observed to that of perfusion. In right decubitus position, mean values of ventilation of the dependent and upper lung were 59.1 and 40.9%. In left decubitus position, However, mean percentile ventilation in the dependent and upper lung were 38.8 and 61.2% respectively, and no shift of the ventilation to the dependent lung was observed.

In ^{133}Xe study, the dependent lung was better perfused in both decubitus positions. The dependent lung was also better ventilated in right decubitus position, however, the ventilation of dependent lung was lesser than that of upper lung in left decubitus position. These results in ^{133}Xe study were similar to those obtained in ^{81m}Kr study. The paradoxical phenomenon of ventilation in left decubitus position is different from the previous reports, and the exact mechanism remains to be a subject for the further study.