Significance of Ventilation and Perfusion Images for Evaluation of overall Gas Exchange Function of Lung

Y. Ishii, H. Ito and K. Torizuka

Department of Radiology, Kyoto University Medical School, Kyoto

T. Mukai

The Central Clinical Isotope Division, Kyoto University Hospital, Kyoto

With recent availabilities of 133-Xe and a scintillation camera, the regional distribution of the ventilation ($\dot{V}$) and the perfusion ($\dot{Q}$) could be visualized simultaneously. Upon processing these images by computer, the ratio of ventilation to the perfusion ($\dot{V}/\dot{Q}$) and relation between $\dot{V}/\dot{Q}$ and $\dot{V}$ or $\dot{Q}$ were expressed as quantitative distributions.

Since the effectiveness of gas exchange function has been evaluated as the alveolar-arterial partial gas pressure difference, (A-a)·D, present attempt is concerned with these presentation of the camera data to be correlated with the (A-a)·D theoretically. It is speculated that constituent of gas content concerning P_{O_2} and P_{CO_2} can be determined solely by the $\dot{V}/\dot{Q}$ value at a milion of alveolar units, so the overall gas content both of $\dot{V}$ and $\dot{Q}$ can, therefore, be calculated by weighted averaging, if the distribution of the $\dot{V}$ for $\dot{V}/\dot{Q}$ and $\dot{Q}$ for $\dot{V}/\dot{Q}$ are known.

The normal distribution in an upright position of $\dot{V}$ for $\dot{V}/\dot{Q}$ and $\dot{Q}$ for $\dot{V}/\dot{Q}$ were shown to be a log normal distribution with a narrow standard deviation. There observed to be a slight dissociation between these distributions due to the difference of gravity effect on $\dot{V}$ and $\dot{Q}$, and the dissociation was, then, calculated to be within normal range of (A-a)·D.

In term of $\dot{V}/\dot{Q}$ inequalities, there exits a region of physiological dead space, where the $\dot{V}/\dot{Q}$ is high, and a region of physiological shunt, where the $\dot{V}/\dot{Q}$ is low. In case of the dead space, much of the $\dot{V}$ distribution was corresponded with high $\dot{V}/\dot{Q}$ value, resulting a magnification of (A-a)·D_{CO_2} to be calculated. In case of the shunt, much of the $\dot{Q}$ distribution was corresponded with low $\dot{V}/\dot{Q}$ value, resulting a magnification of (A-a)·D_{CO_2} to be calculated. These calculated values were well within the range of the laboratory blood gas findings.

Present attempt might provide a good insight in evaluating for the ventilation-perfusion inequalities of the camera data to be correlated with an overall gas exchange efficiency of lung in term of (A-a)·D.

Measurement of the Regional Pulmonary Function using ^{133}Xe.

T. Katsura, K. Narabayashi, S. Yoshida and T. Maeda

Department of Radiology, Kobe University, School of Medicine, Kobe

We tried to obtain a quantitation of regional pulmonary ventilation and perfusion in various pulmonary diseases with ^{133}Xe using a spirometer.

Samples and Methods: 3 cases of normal, 2