III. Lung Heart and Circulation

Functional Scanning Related to Pulmonary Perfusion and Ventilation by Scintillation Camera

J. MATSUOKA, Y. NOHARA and M. TAKAYASU

The Third Department of Internal Medicine

Y. ISHII, T. KOSAKA, T. MUKAI, K. TORIZUKA and K. HAMAMOTO

The Central Clinical Radioisotope Division

M. KAMADA

The Chest Disease Research Institute, Kyoto University School of Medicine, Kyoto

The purpose of this investigation is to combine the static distribution and dynamic change of lung function related to ventilation and perfusion. This objective has been accomplished by calculating washout slope for each element of a scintillation camera field, which is converted onto magnetic tape as digitized number of 40×40 matrices, following perfusion on the lung with dissolved ^{133}Xe injected intravenously as a single bolus. Serial scans of the tracer distribution were obtained at every 3.3 seconds so that ventilation rate constant of the washout could be established and initial distribution extrapolated to initial time to determine distribution of perfusion. The ventilation rate at each element was contained either by the least squares fitting method or by the height over area method. The latter method resulted in a reliable imaging, because the large statistical fluctuations between adjacent elements due to the small number of counts were obviated using integral of a number of counts and the highest counts per each element.

This functional imaging of ventilation rate at each sites of lung scan representing distribution of alveolar ventilation would provide a new tool for the diagnosis and evaluation of various abnormalities of this organ. In normal cases, the distribution pattern of ventilation rate was nearly identical with that of perfusion, preserving regularity and preponderating over lower lung field according to gravitational effect in upright position. In cases of heart disease with pulmonary congestion, the gravitations effect were lost. In some cases of obstructive lung disease, irrespectiveness between ventilation and perfusion with irregularity were observed.