K. Heart, Lung and Peripheral Circulation

Computer Processing on the Determination of Total and Regional Pulmonary Functions (Functional Imaging) Using $^{133}$Xe

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The purpose of this paper is to investigate the computer processing for the determination of total and regional pulmonary functions using $^{133}$Xe. A dose of about 4 mCi of $^{133}$Xe was used for perfusion study and 8 mCi for inhalation study. Sequential 2 second frames in $64 \times 64$ matrix form were acquired with a joint camera-computer system (GCA-202, DAP-5000N). Pulmonary function indices of IC, FRC, TLC, IC/TLC, FRC/TLC and mean transit time (MTT) were estimated for each of the total, left and right lungs, and printed out automatically.

For the assessment of the regional pulmonary functions, functional imaging was performed using four indices of normalized ventilation ($\dot{V}$) index, normalized perfusion ($\dot{Q}$) index, ventilation-perfusion ratio ($\dot{V}/\dot{Q}$) and MTT as parameters. Also, relative standard deviations (RSD) for each of these parameters were computed to examine the statistical error for this processing. The computed values for overall matrix elements were displayed on a CRT with calibration dots and recorded by a polaroid camera.

The effect of the map smoothing on the quality of the functional images was examined observing the functional images smoothed with various filter factors and the respective RSD maps.

In view of the resolution and the statistical error, the map smoothing with filter factor of 10.2 appeared most suitable. In normal case, each functional image of four parameters processed by this suitable condition presented diffuse distributions. The mean values of RSD for overall matrix elements over the lung field were about 7 percent in the $\dot{V}$ index, the $\dot{Q}$ index and the $\dot{V}/\dot{Q}$ functional images and about 5 percent in the MTT.

It is considered that our method of $^{133}$Xe pulmonary function study with the on-line computer system is of special values for clinical use, since total and regional pulmonary functions were either automatically printed out or displayed in the form of images with a few minutes.

Clinical Evaluation of the On-line Computer-aided Pulmonary Function Study Using $^{133}$Xe

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Clinical evaluation of on-line computer-aided $^{133}$Xe pulmonary function study was discussed. In this method, estimated values for the total and differential lung function indices are automatically printed out and regional functions are displayed as functional images which have a frame mode with $64 \times 64$ matrix (0.5 cm x 0.5 cm of unit area) showing continuous distribution of estimated values for each of various pulmonary function indices as brightness. All studies were performed in upright sitting position.

In normal subject $\dot{Q}$-image showed increasing