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REGIONAL LUNG FUNCTION STUDY WITH Xe-133. -EVALUATION WITH PHASE ANALYSIS-

Y.Okuda, H.Maeda, T.Nakagawa, T.Kitano and M.Kaneda. Mie University School of Medicine. Tsu.

During the regional lung function study with Xe-133, sequential image data were collected using a camera-computer-system i a 64×64 matrix form with frame time of 150 msec for 2.5 minites, while the patien was taking tidal breath through a closed circuit after equilibrium. Each of the cycles of the regional time-activity curve over each of the elements of the matrix wa synchronized with the respective cycle of the global time-activity curve over the whole lung field and summed to obtain a representative cycle. A first-harmonic Fourier analysis of the cycle provided functional images displaying distribution of amplitude and phase-shift values. In normal cases phase image showed diffuse distribution, while amplitude image showed marked increase of the value in lower lung fields, supporting the physiological gracity effects. In cases with obstructiv lung diseases, phase image showed irregula distribution, sensitively depicting focal phase delay. The analysis of the regional time-activity curve revealed that this phase delay was resulted from prolongation of early expiratory phase.
This method was considered to be useful beidng performed under tidal breath withou necessity of patient's special cooperation and providing a sensitive regional information on the respiratory cycle.

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INVESTIGATION OF LOCAL FLOW VOLUME CURVE BY MEANS OF RADIOISOTOPE.

A.Sasaki, Y.Mori, H. Sekine, F.Tsujimoto, K.Kawakami, T.Shimada*, N.Katsuyama†**S.Tominaga†** Y.Iikura****. Dept of Rad & *3rd Int Med, Jikei Uni Sch of Med, Tokyo.**Dept of Rad, Ryukyu Uni, Naha. ***Dept of Int Med, Juntendo Uni, Tokyo. **** National Pediatric Hosp, Tokyo.

We investigated local flow volume(F-V) curve of the lungs by means of Xe-133 or Kr-81m inhalation with air or He.
Methods: After equibrium of the Xe-133 or Kr-81m in the lungs, the subjects did forsed expiration. Change of activity per second ($\Delta C/\Delta t$) and activity from TLC to RV(C) were plotted in ordinate and abscissa respectively.
Results:
1) RI slope ratio(SR) $\dot{V}30$ was well related to SR $\dot{V}30$ by means of spirogram.
2) In localized obstructive pulmonary disease, local RI F-V curve detected abnormality in spite of no abnormality on global spirographic F-V curve.
3) In normal cases, value of RI-SR30 He/RI-SR30 air always indicated more than 1.1. In many of COPD patients, it was less than 1.1. Namely, in normal cases. RI-SR responded to He gas, but in COPD patients, RI-SR did not well respond to it.
In this method, we could detect localized obstructive pulmonary disease in cases with normal F-V curve.

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IMAGING OF THE LUNG MOTION DURING VENTILATION.

T. Fujii, J. Hirayama, S. Kusama, H. Hirano, K. Yano and M. Takizawa. Shinshu University School of Medicine. Matsumoto.

Using perfusion lung scintigram, image of the motion of regional pulmonary area and lung edge during ventilation was obtained in patients with various respiratory diseases. Image at maximal inspiration (I) and expiration (E) were recorded after the intravenous injection of Tc-99m MAA (5～10 mCi) using a scintillation camera with a small digital computer. Changes of the radioactivity in each pixel during ventilation were calculated according to a expression as (E-I)/I, and the image of (E-I)/I was obtained.

The image of (E-I)/I was consisted of positive and negative components, and that of positive one visualized the motion of the regional pulmonary area and that of the negative one revealed the limits of the motion of the lung edge during ventilation. Sum of the positive (E-I)/I in the both lungs of the anterior image was correlated with vital capacity (r=0.66) and that of posterior image (r=0.81).

This technique is seemed to be useful for the estimation of the regional pulmonary ventilation and motion of the lung edge.

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ESTIMATION OF REGIONAL VENTILATION WITH MEASUREMENT OF RESPIRATORY VOLUME.

K.Takahashi, A.Komatani, T.Toshiyasu, K.Yamaguchi, *H.Ikeda and *K.Takahashi. Department of Radiology and *1st Internal Medicine. Yamagata University School of Medicine.

In order to correct respiratory pattern changed by pursed lip breathing (PLB), a new analystical technique was developed on the Xe-133 regional ventilation study. Pulse signals corresponded to a starting point of each expiratory phase and a pulse of every 10 ml of expiratory volume were generated by a microcomputer system (NEC PC-8801). Each pulse signal was put into the terminal for cardiac trigger pulse and one side of dual energy input terminal of the GAMMA-11 system (DEC) respectively. Image data of the lung by a gamma camera was also acquired simultaneously. Then the functional image and histogram of washout volume to reduce the radio-activety by half (V 1/2) were compared with those of washout time (T 1/2) and breathing times (B 1/2).

Functional image and histogram derived from washiout volume were superior to T 1/2 or B 1/2 in estimating an effect of PLB in the patients of CPE.