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COMPARISON BETWEEN SINGLE BREATH AND SEMI-EQULIBRIUM METHODS FOR EVALUATING EFFICIENCY OF REGIONAL VENTILATION BY ^{133}Xe GAS INHALATION.

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We evaluated the difference in clearance times of inhaled ^{133}Xe gas between single breath and semi-equilibrium methods in a balloon-box system.

With single breath method, real half time (T1/2R), half time estimated from exponential curve fitting (T1/2exp), and TA,H previously reported were calculated for the whole and regional lungs divided into 16 x 16 matrixes (ca. 2.0 x 2.0 cm in size). With semi-equilibrium method, another clearance time index named T(A/H) also reported previously and a "turn over rate" (Minute ventilation (Vmin)/functional residual capacity (FRC) + tidal volume (V_T)) were calculated.

All these indexes obtained with single breath and semi-equilibrium methods had good correlations with FEV1.0%. With semi-equilibrium method, all these indexes were inversely proportional to the "turn over rate". Correlationship of T1/2R's, T1/2exp's, TA,H and T(A/H) between single breath and semi-equilibrium methods was so good that all these indexes calculated with either method seemed to serve as good indexes of regional ventilation. T1/2R's, however, were not always calculable, and T1/2exp's did not necessarily reflect the charactristics of washout curves. With semi-equilibrium method, TA,H and T(A/H) had good correlations with T1/2R with a less statistical error and were always calculable.

In conclusion TA,H and T(A/H) seemed to be the best indexes of regional ventilation and lung function.

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INVESTIGATION OF GATED SPIROMETRIC XE-133 VENTILATION IMAGES-CORRECTION FOR LUNG MOVEMENT-.

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The purpose of the study is to design a program for lung motion correction of gated spirometric XE-133 images and apply it to phase analysis.

A peak detector selected an inspiratory peak as a trigger of respiratory motion analyzing spirometric signals from a xenon gas control system through which patients rebreathed Xe-133 gas with constant rate. The trigger signals were recorded in a minicomputer (Scintipac-1200) simultaneously with posterior lung images for 60 respiratory cycles.

Data processing of gated images were automatically performed within 6 minutes.Correction for lung movement was done without distorting the lung volume information(total counts) in the image.Each gated image(Image A) was stretched to match the contour of endinspiratory image(Image B) by linear coordinate transform.The equations can be written as:X=A1X+A2Y+A3,Y+B1X+B2Y+B3. Transform parameters were determined by computer selected 3 points of corner of rectangle which circumscribed the contour of Image A and B.

Phase analysis images without geometrical correction showed gradual decrease in amplitude from base to apex because of diaphragmatic motion.While phase images with geometrical correction revealed homogenous distribution in amplitude and phase.

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INVESTIGATION OF SPIROMETRIC GATED XE-133 IMAGING -CLINICAL EVALUATION-.

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The purpose of the clinical study is to evaluate the quantitative analysis of phase image of gated spirometric Xe-133 imaging.

Materials included 13 normal volunteers(N) and patients with COPD(I,24),lung cancer(II, 5),pulmonary embolism(III,4)and others(IV, 20).51 out of 66 subjects were performed conventional spirometry within two weeks of gated study. The standard deviation(S.D.) of phase distribution histogram was employed as parameter of uniformity of phase distribution.

S.D. of phase histogram correlated well with FEV %(r=0.71;p 0.001) and less prominently with %VC(r=0.42;p 0.01).Mean S.D.in N was small(6.3+1.5(mean+s.d.)).Mean S.D. in I,II,III and IV showed 12.3+6.5,9.7+5.2, 9.1+4.6 and 8.5+6.4 respectively.Except for III,Mean S.D. in respiratory disease revealed significantly larger than N.

It is suggested that S.D of phase histogram is useful parameter of uniformity of regional pulmonary ventilation and available to evaluation of obstructive disturbance.

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PHASE ANALYSIS OF VENTILATION STUDY WITH 133-Xe GAS.

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Ventilation study with 133-Xe gas was performed for the study of pulmonary diseases. Amplitude and phase image was obtained by phase analysis of the data of ventilation study with 133-Xe gas.

The patient was placed in a supine position on the bed and the scintilation camera was positioned in the anterior projection of his chest. Ventilcon was used for the Ventilation study. The data was collected by computer for 200 seconds from begining of inhalation to wash out. Tha wash out and standard deviation of the phase histgrams was calculated. The patients with pulmonary disorders, for example, diaphragmatic hernia, lung tumor, lung cyst and Swyer James syndrome were examined.

In normal subjects, the standard deviation of phase histgram in the right and left lung were almost same, but different in patients with pulmonary disorders.

In quantitative analysis, we obtained interest and useful results according to the ventilation study with 133-Xe gas by phase analysis.