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EVALUATION OF PATHOLOGICAL EARLY AIRWAY CLOSURE BY Kr-81m INHALATION STUDY. T. Shimada, K. Kawakami, N. Katsuyama, R. Kawai, C. Ishii, M. Tsukioka, A. Yoshitake, S. Tominaga* and Y. Iikura** Dept of Medicine, Dept of Radiol., Jikei Univ. School of Med., Dept of Respiratory Med., Juntendo Univ. School of Med*, and Dept of Allergy, National Children's Hospital**. Tokyo

This communication aims to evaluate a pathologic condition of gravity non-dependent airway closure in asthmatic patients. A bolus of 10 ml of Kr-81m gas inhaled from various lung volume level (FRC, RV, TLC-400 ml, etc), with slow (0.25 l/sec) and maximum inflation rate. Distribution of Kr-81m was imaged and processed by a scinticamera linked to computer. In the asthmatics, there were two types of distribution pattern. (1) The defect was prominent in slow inhalation, which disappeared by inhalation at high lung volume and was filled up fast inhalation. This finding appears to demonstrate pathological early airway closure. These patients showed marked reduction of FEV₁ and VC. (2) The defect was prominent in fast inhalation, which was filled up in slow inhalation from RV as well as from high lung volume. This finding, appeared frequently during asthmatic attack, suggests broncho-constriction in the larger airways. Reduction of pulmonary function in this group was less than that in the group (1) and recovered after remission.

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RADIOAEROSOL INHALATION LUNG CINE-SCINTIGRAPHY IN VARIOUS LUNG DISEASES. T. Isawa, T. Teshima, T. Hirano, A. Ebina and K. Konno Department of Medicine, The Research Institute for Chest Diseases and Cancer, Tohoku University. Sendai

"Radioaerosol inhalation lung cine-scintigraphy" is a new modality of lung imaging for visual and numerical evaluation of mucociliary clearance mechanism in the lungs. The concept of this modality was presented before this Society in 1980. In short a continuous measurement of radioactivity is made by a gamma camera over the thorax and multiple sequential images of every 10 seconds are made by a computer. The images are sequentially displayed at 18 frames per second so that the movement of radioactive mucus in the lungs and the airways is visually evaluated. In addition clearance rates in any regions of interest and mucus transport velocity over the large airways can be calculated. In normals inhaled aerosol deposits evenly in the lungs and mucus transport is cephalad in direction and steady in transport without stagnation. In airways disease cephalad transport is disturbed showing stasis, retreat or even migration into the opposite bronchi. In pulmonary vascular diseases, however, normal cephalad transport without stagnation was a rule. In sarcoidosis or generalized fibrosis, transport over the major airways was not disturbed. These abnormalities in mucociliary clearance could potentially be causative of superimposed infections.

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ANALYSIS OF MUCOCILIARY CLEARANCE IN THE HEALTHY LUNG. Kamishima, K. Shida, A. Kawakami, Y. Murao, M. Furudate, M. 1st Department of Internal Medicine and Department of Radiology, School of Medicine, Hokkaido University. Sapporo.

The influence of physiological and environmental factors on human mucociliary clearance was studied in 37 healthy persons. Tc-99m albumin aerosol was inhaled during a rapid, shallow breathing to enhance proximal deposition. Then, the subject rested in the supine position through the 1.5-hour study. Retention of deposited aerosol in the lung, as a function of time, was quantified using gamma camera and subsequent computer analysis. The results was analyzed both for total right lung clearance and for clearance from three concentric areas representing central, mid, and peripheral regions of the right lung. Total lung clearance was very reproducible within subjects, but there was significant variation in clearance among subjects despite the good reproducibility of deposition. Clearance did not relate directly with every respect of age, sex, physical characteristics and pulmonary functions except for \dot{V}_{25} . Smokers had a significantly faster clearance rate not only in the total lung but also in the mid and outer regions of the lung, although no significant differences in the deposition pattern was found in the two groups. This acceleration of clearance in smokers may be due in part to an increased quantity of mucus. Smoking is one of the important factors influencing mucociliary clearance and contributes to its large inter-subject differences.

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NUMERIZATION OF "UNEVENNESS" ON LUNG IMAGES. T. Teshima, T. Isawa, T. Hirano, A. Ebina and K. Konno Department of Medicine, The Research Institute for Chest Diseases and Cancer, Tohoku University. Sendai

The term "unevenness" of the lung images has been used rather vaguely in perfusion and inhalation studies. The "unevenness" on lung perfusion images often indicates the presence of chronic obstructive pulmonary diseases, whereas the peripheral and central patterns on aerosol inhalation lung images are seen in chronic bronchitis and pulmonary emphysema, respectively.

The purpose of the present study was to numerize the "unevenness" on lung images and to see if there were any characteristic features among disease entities.

The lung images were made in the matrix of 64 x 64 by a gamma camera and its computer system. Many parameters such as number of peaks; N, maximum count; CMAX, half width of maximum peak; HW, difference between maximal and minimal values; D_i , sum of D_i ; L and mean and standard deviation of D_i ; \bar{D} and SD, respectively, were used for this numerization. CMAX, D_i , L, \bar{D} and SD were normalized by counts per matrix.

The basic concept of "unevenness" and its application were presented. This approach will prove to be of great use in the characterization not only of lung images but also images of other organs such as the liver or the heart.