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Xe-133 INHALATION STUDY CORRELATED WITH X-RAY CT IN PATIENTS WITH DIFFUSE PANBRONCHIOLITIS. G.TODO,H.ITOH,K.MURATA,H.MAEDA,N.TAMAKI,K.MUKAI,T.FUJITA,T.ODORI,K.TORIZUKA, AND T.IZUMI*. KYOTO UNIVERSITY SCHOOL OF MEDICINE. *CHEST DISEASE RESEARCH INSTITUTE KYOTO.

Xe-133 inhalation study and lung CT were done within 3 weeks interval in 9 cases with pathologically proven diffuse panbronchiolitis.

Xe-133 washout curve was analized with initial slope method. Time constant(λ) was calculated pixel by pixel,and histogram of λ was made.Unevenness of washout could be evaluated by SD and peak numbers. Median number of histogram correlated well with Pa O2 (r=0.885).

Washout delay of Xe-133 was found in areas where peribronchiolar nodule was recognized on CT. We classified the lateral washout image into 3 types;peripheral,lobar,and mixed type. Major airway lesion was fuound in all 3 cases of lobar type,but not in any 3 cases of peripheral type. Various degree of major airway lesion was found in mixed type. However,chronic bronchitis with central bronchial wall thichening without peribronchiolar nodule on CT didn't show lobar type washout delay. In lobar type washout delay cases,it was considered that major bronchial lesion itself played insignificant role

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RADIOAEROSOL INHALATION LUNG CINE-SCINTIGRAPHY AND MUCOCILIARY CLEARANCE MECHANISMS IN NORMAL SUBJECTS. T.Isawa, T,Teshima, T.Hirano, A.Ebina and K.Konno. Tohoku University, Sendai.

Radioaerosol inhalation lung cine-scintigraphy is a useful and informative means to evaluate visually how mucociliary clearance mechanisms are functioning in the lungs. In normal subjects aerosol deposition in the lungs was homogeneous, and mucus transport on the airways was cephalad in direction and constant and steady in migration. Besides visual evaluation, several parameters were proposed. For numerical analysis, at time 0, radioactivity at various sites was assumed as follows; Ao+Bo+Co=To; here, A; extrapulmonary airways, B; interapulmonary airways, C; non-ciliated airways and/or the alveoli, and T; total radioactivity. At time t, At+Bt+Ct=Tt. If corrected for physical decay, Atc+Btc+Co=Ttc. The parameters were defined as follows; 1) Lung reteniton ratio; Ttc/To, 2) Airway deposition ratio, (Ttc-Co)/To, 3) Airway retention ratio, (Ttc-Co)/(To-Co), 4) Airway clearance efficiency, (To-Ttc)/(To-Co), and 5) Alveolar deposition ratio, Co/To. Lung retention and airway deposition ratios were significantly different between smokers and non-smokers but airway retention ratio and airway clearance efficiency were not different. Alveolar deposition ratio was significantly smaller in the smokers (24±2%, mean±S.E, n=5) than in non-smokers (47±3%, n=4), and there was a good correlation between the alveolar deposition ratio (y) and cigarette consumption in pack-year (x); $y=43.65\pm0.64x$, $r=-0.84$, $p<0.05$).

In conclusion the reason why alveolar deposition ratio is less in smokers is that smokers could have some subclinical bronchoconstriction. Airway clearance efficiency, however, was not deranged in normal smokers.

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MUCOCILIARY CLEARANCE IN COPD STUDIED BY RADIOAEROSOL INHALATION LUNG CINE-SCINTIGRAPHY. T.Isawa, T. Teshima, T.Hirano, A.Ebina and K.Konno. Tohoku Univ. Sendai.

Radioaerosol inhalation lung cine-scintigraphy in patients with chronic obstructive pulmonary diseases (COPD) indicated that inhaled aerosol deposited not only inhomogeneously in the lungs but also its transport on the airways for mucociliary clearance was extremely irregular in patterns. Of 16 patients studied, nine showed regurgitation or retrograde migration after being transported once in cephalad direction, five showed migration of radioactivity into the opposite bronchi instead of toward the trachea and to and fro migration between the right and left bronchi, eight showed stasis or stagnation of radioactive transport on the airways before coughs and/or hawks propelled the mucus and four showed spiral or zigzag motion in mucus migration on the large airway mucosa. Such bizarre mucociliary clearance patterns in COPD were visually well appreciated by aerosol inhalation lung cine-scintigraphy.

Lung retention ratio tended to be larger in patients with COPD than in normal subjects. Airway deposition and retention ratios were also significantly larger in the former than in the latter, indicating less efficient mucociliary clearance in patients with COPD. This was verified by the index of airway clearance efficiency. Alveolar deposition ratio (13±1%, mean±S.E. n=7) was significantly smaller than that of the normal subjects (34±5%, n=9) ($p<0.05$).

In conclusion patients with COPD showed less alveolar penetration of inhaled aerosol and irregularly deranged and less efficient mucociliary clearance mechanism.

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THE MECHANISM OF THE ALVEOLAR CLEARANCE OF Tc-99m-LABELED AEROSOL PARTICLES. T.Suzuki, H.N.Wagner,Jr. Shiga Medical School. Ohtsu and Johns Hopkins Medical Institutions, Baltimore, Md. U.S.A.

Using a gamma scintillation camera, computer and recently developed aerosol delivery system, we measured pulmonary clearance of small ($Tc\text{-}99mO_4^-$, Tc-99m DTPA and Tc-99m disofenin) and large molecules (Tc-99m albumin) incorporated in submicron aerosol particles in dogs. Tc-99m-labeled aerosol particles were produced by the newly designed modifier (a virtual separator) which removes aerosol particles larger than 1.0μm in diameter. Mass median diameter of the modified aerosol particles was 0.455 μm with a σg of 1.40. The clearance curves of the small molecule Tc-99m compounds were biphasic. The lung clearance rate (T 1/2) of the rapid first compartment of $Tc\text{-}99mO_4^-$ was 7.0 minutes; that of Tc-99m DTPA 29.0 minutes; and that of Tc-99m disofenin 45.3 minutes. The rates of clearance correlated with their molecular size index (Kav) which was determined in methanol/Tris buffer by Sephandex gel chromatography. The lung clearance curve of Tc-99m albumin was logarithmic with a clearance rate (T 1/2) of 19.6 hours. Small molecule Tc-99m compounds in aerosol particles seemed to be cleared passively from the alveolar space into the capillary through junction pores in the alveolar epithelium. On the other hand, the large moleucle, Tc-99m albumin, are thought to be cleared by pinocytosis or phagocytosis.