G. Lung, Heart and Blood Flow

Fundamental Analysis of Aerosol and its Deposition to the Lung

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(1) Total Deposition of Aerosol to the Bronchial Tree.

The theoretical analysis was made concerning the deposition of the aerosol in the human airways, depending on various size of particles. The result showed that the aerosol comprising the following statistical distribution(CMD: 1 micron, MMD : 2 microns, geometrical SD : 1.6), whould deposit to the more peripheral region of airways.

The calculation was based on the assumption that the flow in the bronchial trees was laminar.

(2) Local Deposition of Aerosol.

Regional deposition in a bronchial model was examined by highly resolutive pin-hole collimator.

The geometry of the bronchial model was that of WEIBEL's model. Remarkable depositions at the carina and the outside wall of the model were showed. At the post stenotic region more excessive depositions were observed where turbulent flow would dominate. The turbulent deposition which includes diffusion, sedimentation and impaction would be the major cause of the local "hot spot".

Radioaerosol Inhalation Lung Scanning: Modification of the Method and Application to lung Cancer

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Radioaerosol inhalation lung scanning is useful for the diagnosis and pathophysiologic evaluation of various chest diseases including pulmonary embolism and obstructive airways disease as reported previously. It also has many shortcomings. One is that with aerosol inhalation lung scanning airflow dynamics is barely elucidated. Another is that aerosol often deposits in the lar-

ynx, the trachea, the carina and the bronchi and is ingested with saliva into the stomach. For studying ventilation distribution extrapulmonary deposition at the above mentioned sites is cumbersome. To minimize extrapulmonary deposition, the following modification in the inhalation method was devised and was found useful. Between an ultrasonic nebulizer and the mouthpiece attached to a non-rebreathing double-J-valve, a blower and a reservior for aerosol were inserted. The reservoir was equipped inside with a non-rebreathing one way valve. The ultrasonically generated aerosol was driven into the reservoir by the blower and was inhaled with tidal ventilation passing through the non-rebreathing one way value inside the reservoir, a leading tube and a double-J-valve and a rubber mouth piece. The size of the aerosol thus inhaled was less than 3 micron in diameter.

Application of this modified inhalation method confirmed in a more definite fashion the previously reported characteristics of radioaerosol inhalation lung scanning. An interesting finding in lung cancer patients was found in addition to the previously reported characteristics. Twenty-nine patients with lung cancer were studied by bronchoscopy and lung function tests as well as by radioaerosol inhalation and perfusion lung scans. Twenty of the 22 patients who showed carinal deposition of radioaerosol had the widened carina and the other two had the normal carina without widening. Five of the remaining 7 patients without carinal radioaerosol deposition showed the normal carina and 2 of the 7 patients showed carinal widening. Thus the correlation between the scan finding of aerosol deposition and the bronchoscopic finding of the carina was good in 25 of the 29 (86.2%). When this was considered a positive rate, a false positive or a false negative rate was 2/29 each. In 10 patients with chronic obstructive lung diseases the positive rate was 3/10 (30%) and it was 14/60 (23.3%) in patients with miscellaneous lung diseases.

Thus carinal radioaerosol deposition in lung cancer seems afford an important information regarding carinal widening due to mediastinal lymph node metastasis.

Clearance of Radioactive Particles in the Lung

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(1) Examinations of the Particles Inhaled.

99m-Tc-Sn colloid was nebulized by ultrasonic nebulizer. The diameter of the aerosol was determined by photoscattering method. The results were, CMD : 1 micron, MMD : 2 microns, and geometrical SD : 1.6. Electro-microscopically