

MUCOCILIARY CLEARANCE MECHANISM : EFFECT OF CIGARETTE SMOKE

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The purpose of the study was to assess the acute effect of exposure to a cigarette smoke on mucociliary clearance mechanism in the anesthetized dogs.

Tc-99m-MAA(0.025-0.05 mg in 0.025-0.05 ml) was placed on the bronchial mucosa distal to the carina following exposure and a migrating distance of the tracer material was measured. The acute effect of exposure to a cigarette smoke filtered through a glass fiber was also studied. The dogs were divided into seven groups which smoked 0, 1, 3, 5 and 8 cigarettes without filter and 5 and 8 cigarettes with filter, respectively. Each group consisted of more than 6 dogs. The test agent was put on the bronchial mucosa 2 minutes after completion of smoking under fiberoptic bronchoscopy. Sequential imaging was made with a gamma camera. To estimate the mean migrating velocity(MMV), a linear regression was calculated from time and the migrating distance.

The average MMV values were 12.0 ± 1.0 mm/min(mean \pm S.E.M.), 11.6 ± 1.5 , 8.3 ± 2.2 , 3.3 ± 0.8 and 4.2 ± 2.3 , when 0, 1, 3, 5 and 8 cigarettes were smoked, respectively, while they were 7.0 ± 0.5 mm/min and 1.3 ± 0.9 , when 5 and 8 filtered cigarettes were smoked, respectively.

In conclusion the exposure of the airway mucosa to a cigarette smoke damages the mucociliary clearance mechanism in a dose-response fashion. Placing a filter to a cigarette can be protective to the mucociliary clearance mechanism to a certain degree as compared with non-filtered cigarette smoke, but even filtered cigarette smoke can be detrimental to the mucociliary clearance action of the airways when the amount of cigarette smoke exposure exceeds a certain level, about 8 cigarettes in number in the dog.

STUDIES OF PULMONARY REMOVAL RATE AND DYNAMIC IMAGE FOR RADIOACTIVE CO₂ AND CO MEASURED WITH POSITRON CAMERA

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Carbon dioxide and carbon monoxide labelled with carbon-11 are positron emitter produced in a cyclotron and have a half life of only 20 minutes. The single breath measurement with radio-active gas, composed of inhalation system and a coincidence positron camera interfaced with an on-line computer system (TOSBAC 3400 Model 31), has been used evaluate regional blood flow and diffusing capacity in 7 normal volunteers and 11 patients with chronic obstructive pulmonary disease (COPD), bronchiectasis, old tuberculosis and benign lung tumor. The subject was supine and took a single breath of about 1 liter of active gas mixing with room air from acrylic box on the inspiratory side. After a short period of breath-holding (15 - 20 sec.), the inspired gas was washed out for rebreathing room air and the expired gas was piped to nylon bag through active carbon and soda lime. Regional clearance rate constant (λ) and distribution index (λ_i/λ_t) were calculated from mono-exponential removal curves measured by external counting over the chest during breath holding. These parameters were calculated for each lung fields divided into 4 zones (bilateral upper and lower lung field). We expected that the clearance rate of ¹¹CO₂ would be limited by perfusion and the rate of ¹¹CO would be limited by diffusion and perfusion in ROI of the lung. While the distribution of regional clearance rate was showed approximately even in normal subject, these parameter were showed uneven in patients with lung disease. In sequential positron image, radioactivity of ¹¹CO appeared in the heart within about 10 seconds after inspiration of active gas. In contrast the appearance time of ¹¹CO in the heart was remarkably prolonged in the patients with disturbance of diffusing capacity. In the washout phase, radio-active CO₂ in the lung decreased gradually in normal subject, but in patients with COPD the activity remained to be hot in the hypo-ventilatory lung fields.