

On Mucociliary Clearance Mechanism; Effect of Cigarette Smoke

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The purpose of the present study is to assess the effect of a cigarette smoke on the mucociliary clearance mechanism in the normal dog by measuring migration of a centrifuged ^{99m}Tc -MAA solution as reported previously. The effect of a cigarette smoke filtered through glass fiber filter paper (Toyo Roshi, GA 200) was also studied which is claimed to trap over 99.5% of particulate phase of a cigarette smoke.

The dogs were divided into the following seven groups; 11 dogs which smoked no cigarette served as control, 6 dogs smoked 1 cigarette, 6 dogs 3 cigarettes, 8 dogs 5 cigarettes, 8 dogs 8 cigarettes, 10 dogs 5 cigarettes each filtered through glass fiber filter paper and 8 dogs 8 cigarettes filtered. Within 2 minutes following completion of cigarette smoking, the test agent was placed on the airway mucosa at about 5 mm distal to the carina through a Cook catheter under fiberoptic bronchoscopic guidance. Sequential imaging was made with a gamma camera and the migrating distance of radioactivity was measured every 1 to 2 minutes. A linear regression was calculated from time and the migrating distance, and its gradient was defined as mean migrating velocity (MMV).

The mean MMV was 12.5 ± 1.5 mm/min (mean \pm S.E.), 11.6 ± 1.5 , 8.3 ± 2.2 , 3.3 ± 1.3 , 4.2 ± 2.3 in the control dogs and in dogs who smoked 1, 3, 5 and 8 cigarettes, respectively. There was a converse correlation ($r = -0.59$) between the MMV and the number of cigarettes smoked with a statistical significance ($p < 0.0001$). The mean MMV in the 10 dogs who smoked 5 cigarettes each filtered through glass fiber filter paper was 7.0 ± 0.5 mm/min. There was a statistically significant difference between the MMVs in the dogs who smoked 5 cigarettes with and without filter. The mean MMV in the 8 dogs who smoked 8 cigarettes with filter was 1.3 ± 0.9 mm/min which was not statistically significant as compared with the counterpart not filtered.

In summary a cigarette smoke damages the mucociliary clearance mechanism of the airway in a dose-response fashion. When the particulate phase is removed from a cigarette smoke, the mucociliary damage is kept less in intensity to a certain number of cigarettes if filtered, but the damage seems inevitable and to the same degree as the number of cigarettes exceeds a certain number or 8 cigarettes in this study.

Evaluation of Aerodynamic Change in the Airway of Patients with Chronic Obstructive Pulmonary Disease using Radioaerosol Scintigraphy

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It is well known that in the chronic obstructive Pulmonary disease (COPD), radioaerosol inhalation scintigraphy revealed an excessive deposition of the aerosol in the central airway which is called "hot spot" formation on the scintigraphy. We investigated the aerosol scintigraphy of COPD in

various stages, and established the grading criteria according to scintigraphic findings comprising extent of peripheral irregularity as well as hot spot formation. The grading criteria was well correlated with a conventional lung function test such as the forced expiratory volume at one sec-

ond ($FEV_{1.0}$) and respiratory resistance by the oscillation method (Rp). This result suggests that abnormal findings of the scintigraphy was thought to be a sensitive regional expression of airway narrowing or obstruction especially in the central airway. To elucidate the relation between the scintigraphic findings and the aerodynamic change in the airway, flow and volume patterns monitored at the mouth simultaneously done during the aerosol inhalation were analyzed. In the case of COPD, increased flow rate in short inspiratory phase followed by diminished flow rate in prolonged expiratory phase was evident, which suggest expiratory disturbance due to the obstruction with

compensational increase of inspiratory flow. In applying this abnormal flow pattern to the Weibel's morphometrical airway model, computational results indicated that excessive aerosol deposition in the central airway took place mostly in the inspiratory phase where the turbulent flow with high Raynald's number was characteristic.

It is concluded that the cnetralization of radio-aerosol deposition is a sensitive non-invasive indicator for abnormal aerodynamic change in the central airway, where expiratory distrubance due to the peripheral airway obstruction induced compensatory inflow turbulancy resulting hot spot formation on the inhalation scintigraphy.

Study on the Scanning Time of the RI Angiocardiography by Use of Gamma Imager

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Time-lapse camera (motor driven 35mm camera) has been used for dynamic imaging of RI angiography, but there is limitation of getting only one frame per one second. Recently more efficient camera such as rapid sequential, multifformat and gamma imager were developed for dynamic study. The quality of dynamic image in different exposure time was studied by using gamma camera and gamma imager.

I) Experimental data

1. Relationship between film density and saturation of the image: The size of the image was definit in the range of 0.6 to 1.8 of film density, but the image taken over 2 was saturated.

2. Relationship between film density and resolution of the image: The resolution with bar phantom is getting more poor over 2 of the film density.

3. Relationship between count density and

quality of the image: Good dynamic images can be got under the condition of exposure time over 0.2 seconds.

II) Clinical data

After bolus injection of 15-20 mCi of ^{99m}Tc -human serum albumin, dynamic cardiac images were taken under following condition of exposure time, such as 1, 0.5, 0.3 and 0.2 second by controlling the intenisty. In the quality of these images, there was no difference between the different exposure time.

From these data, we conclude that RI angiography is applicable even in children and the patients with tachycardia.

Moreover, it is possible to perform the scan with smaller doses of Radioisotope by controlling the intensity of the CRT in cases of ordinary exposure time.