Pathophysiology of Bronchial Asthma, with Special Reference to the Quantitative Observation of the Regional Distribution of Pulmonary Arterial Blood Flow During Asthmatic Attack and Attack-Free Interval

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Twenty-five asthmatic patients were examined for regional pulmonary blood flow during asthmatic attack and attack-free period. The quantitative regional blood flow was examined by using a scinticamera with a computer data analysis system. The relationship between regional blood flow and lung function was examined with arterial blood-gas tensions, and following results were obtained.

1. The reversible phenomenon of decreased regional blood flow during asthmatic attack and its increase during the attack-free interval was observed. Patients with intractable asthma showed an intence decrease in regional blood flow during asthmatic attack and the decrease was also marked during the attack-free interval, suggesting the presence of organic changes in the bronchopulmonary system. In general, there was a significant correlation between the severity of attack and the decrease of regional pulmonary arterial blood flow.

2. There was decrease of regional blood flow in cases with $FEV_{1.0}$ under 1000ml, RR over 4.1 $cmH_2O/1/sec$. With respect to the blood-gas tension, the cases with PaO_2 below 80 mmHg showed a decrease in regional blood flow but there was no distinct correlation between the decrease of regional blood flow with $PaCO_2$ and HCO_3^-.

Lung Perfusion and Ventilatory Changes after Unilateral Bronchography

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The purpose of the present study is to investigate how unilateral bronchography affects pulmonary perfusion and ventilatory function.

Eleven patients with various chest diseases were studied; six with right and five with left bronchography. Fifteen to 20ml of 60% uroklin was instilled into the bronchi of a

unilateral lung under fluoroscopy. All patients were studied by chest radiograms, spirometry, maximum expiratory flow volume curves and perfusion lung scanning before, immediately, 4, 24, 48, and 72 hours after bronchography. Either ^{99m}Tc-albumin microsphere or ^{99m}Tc-MAA was used for perfusion lung scanning except for at 4 hours after bronchography when ^{131}I-MAA was used. Perfusion partition to the right and left lungs was calculated by integrating the cps curves of both lungs simultaneously obtained at the time of scanning. Functional loss of perfusion of the ipsilateral lung was calculated by using Birath's formula (1957).

Perfusion reduction of the ipsilateral lung was most significant immediately after bronchography. Functional loss was from 15 to 73% (average 42±6.5%). Perfusion recovery was steady as time elapsed after bronchography; namely, functional loss was 23±9.8% at 4, 10±6.9% at 24, and 4±4.9% at 72 hours. Nine of the 11 patients showed a perfusion recovery at 24 hours. There was little change in vital capacity, maximal mid-expiratory flow rate and timed vital capacity before and after bronchography. Disappearance of 60% uroklin from the lung was also rapid, leaving the so-called millimeter patterns after 4 hours. Peak flow rate ($\dot{V}_{Peak}$) and flow rate at 75% of vital capacity ($\dot{V}_{75}$) decreased most significantly at 4 hours, but flow rates at 50% ($\dot{V}_{50}$) and 25% ($\dot{V}_{25}$) of vital capacity were most depressed at 24 hours and gradually recovered thereafter. $\dot{V}_{Peak}$ and $\dot{V}_{75}$ were almost parallel with perfusion changes of the bronchographied lung but $\dot{V}_{50}$ and $\dot{V}_{25}$ lagged behind perfusion changes.

Perfusion reduction seems to result from a decrease in alveolar ventilation due to airway narrowing and obstruction by contrast medium and occurs immediately following bronchography, whereas $\dot{V}_{50}$ and $\dot{V}_{25}$ seem to reflect narrowing and obstruction of the small airways which are not well appreciated on perfusion lung scans.

Relationship between Pulmonary Regional Ventilation and Perfusion in Chronic Obstructive Lung Disease

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In order to estimate the relationship between regional ventilation and perfusion of the lung, 18 patients of which 5 with chronic obstructive lung disease (COLD), 6 with the other lung disease than COLD (Non-COLD group) and 7 without lung disease as a control were examined using a scintillation camera with a diverging collimator led to minicomputor system.

With the patients in supine position, the perfusion image in the lung was obtained from the counts of radioactivity of ^{133}Xe which was