The steady state measurement with Xe-133, using Ventilon and a large area scinticamera (Searle, LPOV) combined with computer (Shimazu, Scintipac 230) analysing technique has been employed to evaluate regional lung function of 43 patients with COPD and 40 patients with other lung diseases. The functional images of V, V/Q, MTT (mean transit time calculated from wash out curve for equilibrated gas in the steady state) and V/Q have been made in each cases. Beside, the regional ratios of V, V/Q and V/Q indices were calculated for each lung fields divided into 6 zones (bilateral upper, middle and lower lung fields). The MTT calculated by the height over area method were markedly prolonged in the patients with COPD (m 128.3 sec.) compared with MTT of other patients (m 86.2 sec.). These parameters seemed to correlate with the data of FEV1.0%, RV/TLC, %TLC and PaO2. The findings of regional emphysematous change in the chest roentgenogram seemed to have a relation with these parameters. On the basis of the clinical course, lung function data, chest roentgenogram and Xe-133 functional image, the 26 patients with COPD (FEV1.0% <55%) could be classified into 4 groups.

In 40 asthmatic subjects, the relationship between regional pulmonary ventilation and perfusion was investigated using Kr-81m which had a very short half-life of 13 seconds and could be produced in the gaseous form or in solution. 11 asthmatic subjects in attack were studied before and after inhalation of bronchodilator (salbutamol hemisulfate) and 29 asthmatic subjects in remission were studied before and after inhalation of acetylcysteine. In both asthmatic attack and invoked attack by acetylcysteine, areas of hypoventilation generally showed decreased perfusion but perfusion was less affected than ventilation. These relationships were also found in the course of recovery from attack. These findings suggest that perfusion abnormalities are secondary to ventilation abnormalities in asthmatic subjects.

Pulmonary regional changes with asthmatic attack could be estimated as sequential images of Krypton. Krypton images obtained in patients with asthmatic attack were divided into two types; one showed mainly a regional defect pattern and another mainly spotted defect patterns. The differences in Krypton images did not depend on the difference of bronchoconstrictive substances but of pulmonary function of subjects. In the cases revealing a regional defect pattern it was observed that V25 decreased greatly decreased but V75 decreased slightly. On the other hand, in cases revealing spotted defect patterns it was observed that V25 decreased greater than FEV1.0 and MMF.

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