stored in a 32 × 32 matrix with 4 to 8 seconds intervals. The measurements were performed on a patient of sitting position.

At first 133Xe gas was administered by the ventilation method using the closed-circuit spirometer. The breath-hold was performed in expiration and then in inspiration after the steady state of ventilation was attained. The regional ventilation index was estimated by regional subtraction between counts accumulated during the expiratory breath-hold and inspiratory one. At 7 min-later the washout of 133Xe started. The regional washout half-time was calibrated by the regional washout curves. After the 133Xe washout studies was completed, 133Xe solution was intravenously administered with same position as the ventilation studies. The regional perfusion index was estimated by regional counts accumulated during the breath-hold just after administration.

The regional ventilation to perfusion ratio also calculated. The regional ventilation index, perfusion index, washout half-time and ventilation to perfusion ratio were measured on 7 normal cases, 10 patients of obstructive pulmonary diseases and 6 patients of the progressive systemic sclerosis. The regional pulmonary functional abnormality was disclosed on patients with normal composite pulmonary functions.

The Study of the Small Airway Disease Using Xe-133

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The methods using Xe-133 give the regional dynamic ventilation and blood flow of the lung, and, in addition, are the more sensitive method to analyse the peripheral small airway lesion. We have usually used the analysis of the washout after the intravenous injection of Xe-133 and the ventilation distribution after a bolus inhalation of Xe-133 at the reserve volume "RV-bolus method". The both methods were useful for detecting early small airway diseases. The delay of the washout from the lung region after the intravenous injection of Xe-133, showed the peripheral airway closure during normal breathing at rest, but RV-bolus method showed the airway closure at the reserve volume, as comparable to the "closing volume".

All of smoking in the subjects with the normal chest radiograph, showed the airway closure in the lower lung region, when inspiring as a bolus at the reserve volume, corresponding the losing volume in this dependent lung region, but during rebreathing, Xenon went to most of the whole lung. In the cases of early chronic bronchitis and the remission of the bronchial asthma, RV-bolus method showed the more extensive region of the airway closure than the washout method. But in the cases of the progressed chronic bronchitis and the bronchial asthma in attack, RV-bolus method showed almost the same region of poor or absent ventilation as the washout method.

The airway disease (COPD) involves not only the peripheral small airway lesion but also the central airway lesion, and the latter lesion was detected by the aerosol scintigraphy.

RV-bolus method was the more sensitive for the early small airway disease, but, in the cases of the progressed airway disease, had no advantage over the washout method.