VIII. Lung

Studies on the Regional Pulmonary Function by the Radioactive Xenon. Measurement for the Regional Residual Volume/Regional Total Lung Capacity Ratio and Its Clinical Application

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The regional residual volume/regional total lung capacity ratio (RVr/TLCr ratio) was measured in 9 normal subjects, 5 cases with chronic pulmonary emphysema and 7 cases with chronic bronchitis by 133Xenon, and the following findings were obtained.

1) RVr/TLCr ratio was calculated by the following equation.

\[
\frac{(V_{Cr}-VD_r)F_1}{RV_r-V_{Cr}} = F_{x2}
\]

\[
F_{x2} = F_1 \cdot \frac{U_{x2}}{U_t}
\]

\[
\frac{V_{Cr}-VD_r}{TLC_r} = \frac{F_{x2}}{F_1} = C_{x2}
\]

\[
V_{Cr} = C_{x2} + \frac{VD_r}{TLC_r} \div C_{x2}
\]

\[
RV_r = 1 - C_{x2}
\]

Where, VCr, VDr, RVr, and TLCr are the regional vital vital capacity, dead space, residual volume and total lung capacity, respectively. Fx2 is the calculated concentration of xenon within a zone after deep breath from the RV level and Ux2 is the external counting rate over that zone. F1 is the known concentration of xenon in the lungs after rebreathing and Ut is the external counting rate during full inflation after rebreathing. F1 is the concentration of xenon in the inspired gas.

2) In the normal subjets, RVr/TLCr ratio was decreased from the upper region to the lower region in the sitting position, this finding means that the size of the alveoli is more increased in the upper region than in the lower region. The mean value and standard deviation of the upper, middle and lower region were 43–9%, 35–8%, and 28–9%, respectively. These differences disappeared in the supine position.

3) The size of the scintillation counter did not give any significant effect on the determination of the RVr/TLCr ratio between 1.5 inch and 0.5 inch scintillation counter.

4) The RVr/TLCr ratio was significantly increased over the lung, and the reversal of this distribution was found in some case in the case with chronic pulmonary emphysema.

5) In the case with chronic bronchitis, the RVr/TLCr ratio showed the similar distribution as the normal subjects and showed no significant regional overdistension.

6) This method is very useful to find the regional overdistension and the regional emphysematous changes.