Evaluation of the ventilation-perfusion ratio in lung diseases by simultaneous anterior and posterior image acquisition

Yasunobu Nakata, Isamu Narabayashi, Kozo Sueyoshi, Ritsuo Matsui, Ryuichiro Namba and Kojiro Tabuchi

Department of Radiology, Osaka Medical College

Ventilation and perfusion images were acquired during tidal breathing using ^{81m}Kr gas and ^{99m}Tc-MAA. Anterior and posterior functional images of $\dot{V}/\dot{Q}$ and $\dot{Q}/\dot{V}$ were simultaneously acquired in 34 subjects with various lung diseases and 6 healthy controls. Superimposed anterior and posterior images were constructed and histograms of the frequency distribution for ventilation, perfusion, and the $\dot{V}/\dot{Q}$ ratio were displayed for both lungs as well as for the left and right lungs individually. Blood gas analysis and general lung function tests were also performed on the day before scintigraphy. A correlation between marked uneven distribution of $\dot{V}/\dot{Q}$ and A-aDO$_2$ was found. When the proportion of counts at $\dot{V}/\dot{Q} < 0.67$ and/or $\dot{V}/\dot{Q} > 1.50$ in the $\dot{V}/\dot{Q}$ counts histogram was compared with A-aDO$_2$, there was a significant positive correlation for anterior images (r = 0.684, p < 0.05), posterior images (r = 0.654, p < 0.05) and superimposed images (r = 0.696, p < 0.05). Superimposed images therefore showed the highest correlation. There was no correlation between the results of lung function testing and A-aDO$_2$. Coronal SPECT images were also obtained in 15 patients and compared with the superimposed anterior and posterior planar images. There was a good correlation (r = 0.888, p < 0.001) between both the imaging methods regarding the marked uneven distribution of $\dot{V}/\dot{Q}$. Simultaneous anterior and posterior planar image acquisition reduces the examining time, is simple, and is noninvasive. The present results also suggest that it is useful for quantitative evaluation of the ventilation-perfusion ratio.

Key words: Ventilation-perfusion image, V&P SPECT, ^{81m}Kr gas, ^{99m}Tc-MAA, $\dot{V}/\dot{Q}$ mismatch