## PULMONARY VENTILATION STUDY WITH KRYPTON-81M — DISTRIBUTION OF THE GAS IN VARIOUS INHALATION SPEEDS —

Kenji Kawakami*, Naofumi Katsuyama*, Kunihiko Fukuda*, Tetsuhisa Yamada*, Shimpei Tada*, Sachio Mochizuki*, Takao Shimada**, Shigeoki Wakabayashi***, Yohji Iikura****, Toshikazu Nagakura*****

*Dept. of Radiology, Jikei Univ. **3rd Dept. of Medicine, ***Shimazu, ****National Children Hospital.

Intrapulmonary distribution of boli of Kr-81m gas in various inhalation speeds was studied in 5 normal volunteers, and an ability of slow and fast inhalation speeds to detect uneven distribution of ventilation was tested in 26 patients with chronic obstructive pulmonary diseases.
Method; Kr-81m gas inhaled by the following three techniques,
(1) Several deep rebreathing (distribution of activity in this phase was assumed as lung volume(LV) ).
(2) Slow and (3) fast bolus inhalation of 10 ml of the gas from resional volume, followed by air, to total lung capacity. Distribution of the activity was measured for 10 sec. of breath-holding at total lung capacity. The ratio of counts of bolus inhalation for LV (bolus/LV) was calculated and compared between slow and fast bolus inhalation by mini computor (Scinti paque 200). The value of bolus/LV is smaller as the defects are larger.
Results; In normal subjects, inhaled Kr-81m gas distributes in upper lung fields, with increasing inhalation speed. In patients with COPD, abnormalities were demonstrated in all of 26 patients (100%) by fast inhalation technique, whilst 21 (81%) by slow technique. Fast inhalation technique detected 42 areas of hypoventilation in 26 patients, whilst slow technique 32 areas. This result suggests that fast inhalation technique was recommended to detect uneven ventilation more sensitively.

## CLINICAL EVALUATION OF THE ON-LINE COMPUTER-AIDED PULMONARY FUNCTIONAL STUDY USING $^{133}Xe$ (THREE COMPARTMENT ANALYSIS OF THE WASHOUT CURVE IN NORMAL AND PSS)

Youichi Furukawa, Akinobu Araki, Hisato Maeda Tsuyoshi Nakagawa, Nobuo Yamaguchi and Mituo Taguchi
School of Medicine, Mie University, Tsu

We have previously reported the on-line computer-aided regional pulmonary functional studies. Present studies are devoted to the three compartment analysis of the washout curve in normal and PSS.

The washout curve in upright sitting position could be analyzed into three compartment, namely well ventilated compartment, poorly ventilated compartment and background. Of which, the former two were analized as indices for the lung functions. Well ventilated compartment for the whole lung in patients with PSS, as compared with that in normal subjects, showed a significant increase in both slope ($P<0.05$) and proportion of volume as determined by the percentage of initial height ($P<0.001$).

On the other hand, poorly ventilated compartment showed no significant difference in slope and a significant decrease in the proportion of volume. ($P<0.001$) In the comparative analysis of regional washout curves for upper and lower lung region in normal subjects, well ventilated compartment showed a significant increase in the slope ($P<0.02$) and the proportion of volume ($P<0.02$) for the lower lung region, while, poorly ventilated compartment showed no significant difference in slope and significant decrease in the proportion of volume for the lower lung region. The same analysis in patients with PSS showed no significant difference between upper and lower lung regions in both compartments.

These results will indicate the following pathophysiology in patients with PSS that decreased distensibility due to fibrosis decrease the gravity-dependent variation in alveolar dimension and minimize the difference in both compartments for upper and lower lung fields. In addition, decrease in TLC and relative increase in tidal volume will increase the proportion of the volume of well ventilated compartment, so that the washout will be acceralated in comparison to normal subjects.