

Studies on the Lung Scintigram of Bronchial Asthma (4th Report)

—On the Relation between Gas in the Arterial Blood to Lung Scintigram—

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We reported that lung blood circulation kinetics of bronchial asthma in the child was found by lung scintigram of ^{131}I -MAA intravenous injection and perfusion abnormalities of pulmonary segments was observed on multiple-view scintigrams (6 to 8 projection including anterior, posterior, lateral or oblique).

In this report, we studied that the relation between distribution of local perfusion defects and gas Concentration in the arterial blood of 53 cases.

1) On degree of attacks (no attack, mild attack, intermediated attack and severe attack), the more severe attack was, the more segments were injured.

2) Injured segments were mainly found in the right lung of all patients but were found

in both of the lung in severe patients.

3) Injured segments were found upper or lower region of the lung, and the more cases of lower region abnormalities were found in the more severe attack.

4) Most cases were hypocapnic in attack, and hypoxic metabolic acidosis and light respiratory alkalosis were generally found in arterial blood.

5) On the relation between arterial blood gas kinetics and injured pulmonary segments, the more hypoxic the arterial blood gas was, the more segments were injured and those patients were clinically more severe.

It may be unlikely seen that PH, PaCO_2 and BE were rightly correlated with perfusion abnormalities.

The Application of Gradient's Method to the Computer Analysis of ^{133}Xe Wash-out Curve Via Portal Route for the Determination of the Hepatic Blood Flow

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The purpose of this study is to evaluate the analytic method of the ^{133}Xe wash-out curve through the portal vein for the deter-

mination of the hepatic blood flow in the various liver diseases. Studies were performed on 30 patients at the time of upper ab-

dominal surgery under general anesthesia with a non-rebreathing system or at the time of portography by using trans-umbilical vein technique. The wash-out curves were obtained by the measurement of the radioactivity over the liver with two 1.5" NaI scintillation detectors mounted in the narrow collimators, which were connected to 400 channel analyzer and the digital printer.

The wash-out curves were evaluated in terms of three exponentials using the manual graphic method and the digital computer (Facom 230-25). The computed procedure has been carried out in FORTRAN IV with the program of Gradient's method. In order to estimate a curve fitting between the obtained data and the simulated data on the computer, we have introduced the Index of Performance (I.P.);

$$F(t) = \sum_{n=1}^n a_i \cdot e^{-k_i t} \dots\dots\dots(1)$$

$$I.P.(\text{minimum}) = \sum_{n=1}^n |D_i - F(t_i)| \dots\dots(2)$$

where a_i , k_i are constant, t is time (minute), and D is obtained data.

The computer program was set to minimize the Index of Performance, and this processing technique was called Gradient's method. A linear relationship was found to exist between the computed and the manual graphic values.

The advantages of computation analysis as compared with manual technique are as follows.

- 1) There is no necessity of replotting the data on semilog scale.
- 2) Computed automatic fitting is possible to make the objective determination on number of exponentials.
- 3) Speedy and relatively accurate estimation is clearly observed.

Muscle Blood Flow Measurements with ^{133}Xe and $^{99m}\text{TcO}_4$ in Patients with Muscular and Nervous Diseases

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The purpose of this paper is to present the results of measurements of blood flow in the anterior tibial muscle by using ^{133}Xe and ^{99m}Tc -pertechnetate in healthy subjects and in patients with muscular and nervous disorders, and to discuss their applications and limitations.

Six healthy subjects and 25 patients with progressive muscular dystrophy, amyotrophic lateral sclerosis, myelitis, polyneuritis and other neuromuscular disorders were studied.

Chronological radioactivities in the anterior tibial muscle following the intramuscular injection of 100 μCi (0.05–0.1 ml) of a saline solution of ^{133}Xe and a ^{99m}Tc pertechnetate solution were measured with a NaI crystal and plotted on the semilogarithmic paper.

After measuring the resting clearance-rate for 5 minutes, a cuff placed just above the knee was rapidly inflated to a pressure of about 270 mmHg. Following a 2-minute ischemia, the cuff was deflated, and during the subsequent stage of reactive hyperemia the clearance rate was measured for 10 to 20 minutes. Clearance curve following deflation consists of 2 components—rapid phase with a half-time ($T_{1/2}$) of around 10 seconds (phase 2) and slow phase with $T_{1/2}$ of 5 to 20 minutes (phase 3)—.

In healthy subjects, $T_{1/2}$ of phase 2 ranged from 5 to 13 seconds. In patients with marked muscle atrophy, it prolonged, although it was widely distributed and overlapped each other. $T_{1/2}$ of phase 3 was distributed more