Studies of the Intrarenal Distribution of Blood Flow with ^{133}Xenon

A. TAKADA and T. INASAKA

The First Department of Internal Medicine, School of Medicine, Kanazawa University, Kanazawa

Measurement of the renal blood flow using inert gas ^{133}Xe was carried out in patients with hypertension and chronic renal diseases and the results obtained from the ^{133}Xe wash-out technique were compared with those from the dye-dilution method.

The wash-out curves of ^{133}Xe recorded for over 45 minutes were graphically resolved in 4 components, while only 3 components were recognized in the wash-out curves recorded for 30 minutes. The mean values of flow rates and ratios in component I and III calculated from the curves for 30 minutes were compatible with those of component I and IV from the curves for 45 minutes, respectively. The mean value of component II from the curves for 30 minutes was almost the same as that of the average of the means of component II and III from the curves for 45 minutes. Statistically significant correlations were observed between the corresponding components from both observations, except flow rates between component II of the 30 minutes observation and the average of component II and III of the 45 minutes observation. These results suggested that component I, II and III of the 30 minutes observation probably represent the cortical, medullary (including outer and inner medulla) and extrarenal blood flow respectively.

Comparing the graphical and numerical methods, better reproducibility was observed in the graphical analysis, although a significant correlation was found in component I between both techniques.

Correlations of the flow ratios of the cortex and the medulla between the measurements with the ^{133}Xe wash-out method and dye-dilution methods descried by Takeuchi and coworkers were statistically significant, while the values obtained from the dye-dilution method according to the description of Reubi et al. were not correlated to those from the ^{133}Xe wash-out method.

In the patients with impaired renal function, flow rate of the cortex (component I) was decreased and that of the medulla (component II) was unchanged, consequently the ratio of the cortical flow was decreased and that of the medullary flow was increased. This result was the same as that of the previous report from our laboratory using dye-dilution method.

Renal Cortex Blood Flow Measured by the ^{85}Kr and Semiconductor β-Detector

K. KITANI

Second Department of Internal Medicine, University of Tokyo, Tokyo

Continuous recording of the radioactivity of β-ray of ^{85}Kr introduced into the renal artery was done by the use of the semiconductor radialion detector which was placed just over the surface of the kidney for the measurement of cortical blood flow by clearance method. In dog experiments, the blood flow obtained by this method corresponded well with the flow value calculated from the first component of the clearance curve of the external γ-metry, which is accepted as the cortical flow. In the

analysis of the clearance curve by β-metry, the calibration for the absorption effect of ^{85}Kr to the surface coating substance of the detector was needed. Details of this study has been reported from author's department in the 5th annual meeting of the Japanese society of nephrology in 1968.

Studies on the Lymph Circulation

T. WATANABE

The Second Department of Surgery, Kyoto Prefectural University of Medicine, Kyoto

Lymphatic circulation system, which is a part of body fluid circulation, begins from tissue fluid and lymphatic capillary vessels, and so comes to venous system via thoracic duct. We call it "third circulation".

For seven years, we have studied on the lymphatic flow in thoracic duct, protein and electrolytes contents in lymph and the distribution of radioisotope (RISA, ^{35}S) in body fluid under experimental conditions and then we have thought about the dynamics of lymphatic circulation.

It is interesting to examine how the circulation of body fluid does change under the condition where blood circulation is maintained by artificial heart-lung machine. These experiments showed that greater increase in lymphatic flow is a good indicator for finding out microscopic edema of tissues and organs, and also reflects the change in microcirculation at capillary level sensitively.

Some factors are considered as follows; Osmotic pressure, hydrostatic pressure, hemostasis and permeability, which give the important influence on the increase in lymphatic flow in thoracic duct resulting from the disturbance of microcirculation.

Under inadequate perfusion sludging and microthrombus, which are still reversible, are observed under special microscope, and so disseminated intravascular coagulation and venular junction bleeding in long-term perfusion are observed.

Under inadequate perfusion, the serial histologic studies by liver biopsies show some changes. Congestion and bleeding in sinusoids and slight degeneration of liver cells are found with pressure elevation in portal vein or inferior venae cavae, but 10 minutes later of total perfusion only the small bleeding areas are observed around the central vein of liver and so that degeneration of liver cells is becoming better. After the improvement of such degeneration of liver cells is becoming better. After the improvement of such degeneration, lymph vessels in Glisson's sheath are clearly widening, on the other hand, Hb amounts are increasing in lymph in thoracic duct.

Also, when hepatic vein is experimentally clamped and experimental pulmonary edema is made, it is examined that the lymphatic flow in thoracic duct is more increasing and the equilibrium time of ^{35}S in the blood and lymph becomes longer compared with the control.

These facts indicate the important role of lymphatic circulation, which keeps well the balance between the blood circulatory system and tissue cells, and has some potentiality to repair pathophysiologically abnormal condition of tissues.