The Clinical Evaluation of the Renal Function Test by the Surface Counting Method Using the Radioisotope Hippurn (^{131}I)

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We discussed on the clinical evaluation of the radioisotopic reno-cysto-cardiography by the surface counting method, which was previously emphasised to be recommended for the mesurment of the renal function because it is simple and rapid, in the 29th general meeting of the Japanese Circulation, 1965, Tokyo.

The conclusion can be summarized as follows,

1. The ^{131}I-hippuran clearance value by the ^{131}I-hippuran constant infusion technique was well correlated with the PAH clearance value.
2. The ^{131}I-hippuran clearance was obtained by the reno-cysto-cardiography in which scintillation counting was separately and simultaneously recorded at the four different sites of the body surface, both sides of kidney, urinary bladder and heart areas, following the injection of ^{131}I-hippuran. The formula employed was

$$C\text{Hipp}=\frac{UVt_2-UVt_1}{(t_2-t_1)\times p(tm-a)}$$

The value obtained by this method was also found to be in a good correlation with the PAH clearance value.

3. The comparison between the left and right renal-functions can be performed by the surface counting method above mentioned.

A Few Problems on the Clinical Application of Renogram

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The renal function test with radioisotope has now found its way into many clinics in Japan, however, in order to make this technic prevalent as a routine test, there remain a few important problems concerning with the estimation of its result and renographic technic itself.

The purpose of this report is to discuss about the problems according to our experience.

1) Introduction of a new equipment for renography

Our renographic instrument has two special features in which the first, the log ratemeter with two decades in full sale take the place of ordinary ratemeter and the second, the optimal photopeak from ^{203}Hg, ^{131}I and ^{198}Au is selected quickly by turning a switch round.

2) The decision of the position of kidneys with renographic instrument

Usually the lead collimated scintillation detectors are placed over the area of both kidneys with help of intravenous pyelogram or abdominal simple X-ray film and the detectors does not often indicate the accurate area of kidneys.

In our practice, after intravenous injection of about 20 μCi of ^{203}Hg-neohydrin prior to the administration of ^{131}I-hippuran, the corect renal area is looked for according to the intensity of γ-ray from ^{203}Hg-neohydrin.

The renal position will be decided precisely and the switch of machine will be turned round to ^{131}I from ^{203}Hg.

In this manner, there is no necessity of X-ray film for localization of the kidneys

and besides the possibility of detecting renal function by renal uptake of ^{203}Hg-neohydrin prior to renography.

3) The estimation of renal function by renogram

Renogram was proved to be useful test of each renal function but its estimation so far is settled neither quantitatively nor qualititatively. Renogram can be clinically analyzed into the following 5 types from its characteristic pattern, standard, delayed, hypofunctional, nonfunctional and obstructive.

In practice many misinterpretation may occur unless careful evaluation is made because the result must be influenced by uncontrollable fcators such as the difference of amount of radioactivy injected, the position of detectors and the distance between the detectors and the kidneys. On the other hand, the pattern of renogram can be obtained on log-ratemeter-recorder without risk of misinterpretation.

4) Examples of the practical application of renogram

Although characteristic figure of renogram is obtained on respective renal diseases, it is impossible to make the final diagnosis from renogram alone. But renogram was more informative in cases with renal hypertension, ureteral disease, hydronephroisis, movable kidney, tumor and stone.

To sum up, the instance of the renal diseases in which renography is really indispensable is relatively rare but in the cases with movable kidney and ureteral stone renogram is most helpful to interpretation of function of each side of the kidneys.

Several interesting cases were demonstrated.

The Radiation Effect of Radio-Neohydrin to the Kidney

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The radiation effect of Neohydrin ^{203}Hg to the kidneys with the doses of les than 10 μc/kg and the resulting histological changes (i.e. swelling of the primary tubular cells, hyaline droplet degeneration and swelling of the glomerulus and its adhesion with the Bowman's capsule) has already been reported in our previous paper (Japanese Journal of Nephrology, vol. 6, 1964).

In this study, a series of experiments was performed to investigate the radiation effect of Neohydrin ^{197}Hg to the rabbit's kidneys.

The rabbits were divided into three groups according to their doses administered (10 μc/kg, 100 μc/kg and 200 μc/kg) and their results were compared with that of the control group with 0.5 cc of plain Neohydrin.

The animals were sacrificed on 2nd, 5th and 7th day after the administration and their kidneys were taken out immediately and presented for study. The results were as following;

The radiation effect of Neohydrin ^{197}Hg was noticed in all the three groups and their characteristic histological changes were consisted of slight swelling of the primary tubular cells and proliferation of the mesangial cells. These changes were most remarkable on the 2nd day after the administration and quick recovery was also noted in a week.

As a conclusion, Neohydrin ^{197}Hg should be prefered as a better test material for renoscintiscanning to Neohydrin ^{203}Hg, because of its less ill effect and quick recovery.