The Diagnosis of Renal Cortical Lesions by ^{99m}Tc-DMSA Renal Imaging in Patients with Chronic Pyelonephritis due to Primary Vesicoureteral Reflux

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The primary vesicoureteral reflux (VUR) is one of the causes of chronic pyelonephritis. In the patients with chronic pyelonephritis due to VUR, renal function are impaired gradually. Therefore early diagnosis of VUR is strongly requested. In the past, chief advantage of intravenous pyelography is that it permits visualization of the urinary tract, however is limitted for visualization of renal parenchyma.

In this study, value of renal imaging by ^{99m}Tc-DMSA was evaluated on patients with chronic pyelonephritis due to VUR.

The twenty one cases (29 kidneys) consisted of 15 females and 6 males ranging from 4 to 48 years old (mean 28.4 years old) were examined by ^{99m}Tc-DMSA renal imaging.

Pho/Gamma IV with parallel hole high resolu- and pinhole collimators was used. The images were obtained at 1 to 6 hours after intravenous injection of 1 to 5 mCi of ^{99m}Tc-DMSA.

The grade of ^{99m}Tc-DMSA renal imaging were compared with the grade of intravenous pyelography. Grade of renal images and intravenous pyelography were graded according to the following scales respectively:

Grade of ^{99m}Tc-DMSA renal images: Grade 0= normal renal image, Grade 1=renal image normal in size with cold area (s), Grade 2= small renal image with cold area(s).

Grade of intravenous pyelogram: Grade 0= normal pyelogram, Grade 1=caliceal clubbing without other findings, Grade 2=caliceal clubbing and parenchymal scarring, Grade 3=contracted kidney with clubbing and scarring.

The results were as follows:

1) In 18 kidneys with pyelogram grade of more than 2, all demonstrated cold area on renal image (scintigram grade more than 1).

2) The four kidneys out of 6 kidneys with pyelograde of 0 demonstrated cold area on renal image.

3) One of the 5 kidneys with pyelogram grade of 1 indicated grade 0 on renal image.

Therefore more abnormal lesions were found by ^{99m}Tc-DMSA scintigraphy than by intravenous pyelography.

In summary, renal imaging by ^{99m}Tc-DMSA were found to be useful aid for the diagnosis of renal parenchyma in cases with chronic pyelonephritis due to primary VUR.

Estimation of Renal Cortical Function Using ^{99m}Tc-DMSA and ^{197}Hg-Chlormerodrin

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In clinical studies, the cortical morphology of the normal kidney appeared in the image as a thin peripheral rim of ^{99m}Tc-DMSA activity, while in the case of renovascular hypertension or hydronephrosis, cortical scars were clearly seen in the scintigrams as cortical images. Furthermore,

about 3-6 hours after injection of 5 mCi doses, renal images were obtained more clearly than those of [197]Hg-chlormerodrin.

By these studies, renal scintigram with ^{99m}Tc-DMSA were better than those we previously obtained with [197]Hg-chlormerodrin and very high resolution image of the renal cortical structure can be obtained using ^{99m}Tc-DMSA.

To estimate renal cortical thickness, following studies were performed clinically. C/P ratio (RI counts of area of cortex/pelvis) were calculated from the digitalized scintigrams in the case of normal renal function and chronic nephritis or chronic renal failure. C/P ratio is 1.3–1.5 in the normal renal function, while 1.0–1.1 in the case of chronic nephritis or chronic renal failure and PSP index (15 min.) was correlated well with this C/P ratio.

In comparing a profile curve of [197]Hg-chlormerodrin with that of ^{99m}Tc-DMSA, the profile curve of ^{99m}Tc-DMSA showed high counts in the outer cortex.

Cortical thickness which represents the difference of peak counts of profile curves of these two radiopharmaceuticals was measured in various renal diseases. As a result, cortical thickness was 1.6–2.0 cm in the case of normal renal function, 0.8–1.2 cm in the case of chronic nephritis, 0.0–0.4 cm in the case of chronic renal failure.

By these methods, cortical thickness was estimated quantitatively and furthermore, cortical image were obtained by substraction method of these two scintigrams.

In conclusion, it was suggested that cortical morphology and function were estimated by combination of two radiopharmaceuticals.

Clinical Studies on Renal Function with Scinticamera
—[99m]Tc-DMSA Renoscintigraphy: Early Image—

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We reported that ^{99m}Tc-DMSA renoscintigraphy was superior to static renal cortical image in late time. We obtained early image using ^{99m}Tc-DMSA immediately after injection. And after two hours, we obtained late image. Using early image and late image, we could discriminate renal cyst from renal cancer. In renal cyst, early image and late image are projected as cold spot. In renal cancer, early image are projected as vascular phase and late image are cold spot. In early image, we obtained ^{99m}Tc-DMSA renogram. We studied

correlation between ^{99m}Tc-DMSA renogram and ^{131}I-Hippuran renogram. We knew that T 1/2 in ^{99m}Tc-DMSA renogram curve was good relation of MTT in ^{131}I-Hippuran renogram. We reported that renal uptake of ^{99m}Tc-DMSA was good relation of RPF in ^{131}I-Hippuran Renogram. We knew that renal uptake in early image was good correlation of renal uptake in late image.

Both early image and late image are useful in clinical renal studies.