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Renal scintigraphy in kidney diseases of infants and children

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Renal scintigraphy has become a useful tool in the diagnosis of kidney diseases, especially in infants and children. Advantages versus risks should, however, be carefully considered in each case before complementing the clinical examinations with this technique. Details of the method are given and some cases are presented to illustrate its practical indications.

Application of renal scintigraphy based on reliable clinical indication has provided new diagnostic possibilities in renal diseases of infants and children [1, 2]. Since this examination gives information on the functioning renal parenchyma, it is essentially a supplement to, but does not replace, the radiological study of the kidney [9].

Renal scintigraphy has a considerably greater diagnostic value in infants and children than in adults. This is due to the almost exclusive use of ^{197}Hg bound to chlormerodrin [3] and the avoidance of the ^{203}Hg-labelled preparation which has a half-life of 47.9 days; neither a child nor an adult can be exposed to the high radiation load imposed by this isotope, hence the advantage of ^{197}Hg which has a half-life of 2.7 days. However, from the point of high-quality scintiscans, ^{197}Hg has a number of disadvantages, purely of physical character [5]. There is a considerable loss in information when detecting the radiation of 77 KeV energy emerging from the kidney which is lying in a large dispersing medium, 7 to 8 cm deep beneath the dorsal body surface. Obviously, conditions are more favourable in a child, owing to the smaller size of the body.

A scintiscan obtained in an infant or child using a collimator of excellent resolving capacity suited for the detection of soft beams is significantly richer in details than the picture obtained in an adult. This holds, of course, only for scintigrams done with extraordinary care and up-to-date equipment.

Technique

A double-detector SELO Superscanner Type DS 7/6B is used. The scan is made with the detector lying under the plate of the table with the patient in the recumbent position. In our experience, scintiscans obtained in this way are superior to those revealed by the conventional single-head scanners forcing the patient to lie for 20 to 30 min. Few patients are capable of maintaining this

FIG. 1. Case No. 1. Excretion urography indicates bilateral polycystic kidney

position for such a long period. Furthermore, dislocation of the kidneys due to the respiratory movements may be considerable in the prone position.

The scans were made by a 199-hole focussed collimator produced for the detection of the 140-KeV radiation of ^{99m}Tc. Speed of the detector was adjusted to obtain a minimum information density of 80 imp/cm.

In cases where the two kidneys differed substantially in the uptake of the isotope, a second scintigraphic study was invariably done with the equipment adjusted to the radiation level of the kidney of lower activity. This was necessary because owing to the subtraction of background activity, a significant amount of information was lost, increasing the probability of an erroneous diagnosis. A subtraction of more than 20% was unnecessary with the coloured-dot technique [4].

The radiation load imposed on the kidneys amounts to between 0.8 and 1.5 rad when employing the ^{197}Hg-preparation with an activity of 2 μC per kg, while the whole body load is about 5 mrad [6]. These figures are lower than those encountered in urographic studies.

Kidney scans were done whenever the additional information thus gained was judged to be worth of exposing the patient to the above radiation load. Three case reports will illustrate the clinical value of the method.

REPORT OF CASES

Case No. 1. B. T., a 20-month-old male baby was referred to the Department because of hepatosplenomegaly. On admission, the liver and both kidneys were enlarged. Excretion urography suggested polycystic kidneys (Fig. 1). This could be confirmed by scintigraphy (Fig. 2): on the scan both kidneys were enlarged, the distribution of activity being uneven particularly in the right kidney, with circumscribed defects in the upper pole and near to the medial contour. In the left kidney there was a defect of about 1.5 cm diameter in the cranial pole suggesting the presence of a cyst.

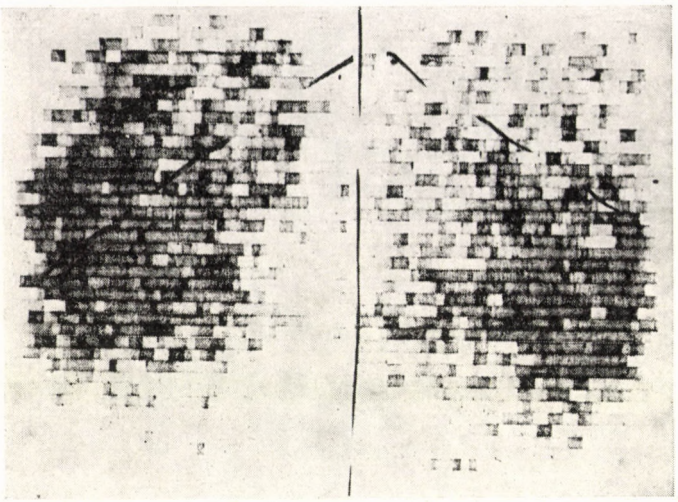

FIG. 2. Case No. 1. Scintiscan. Both kidneys are enlarged. Unevenly distributed activity, particularly in the right kidney. In the upper pole and near to the medial border there are well-defined defects. In the upper pole of the left kidney there is an activity defect indicating the presence of a cyst

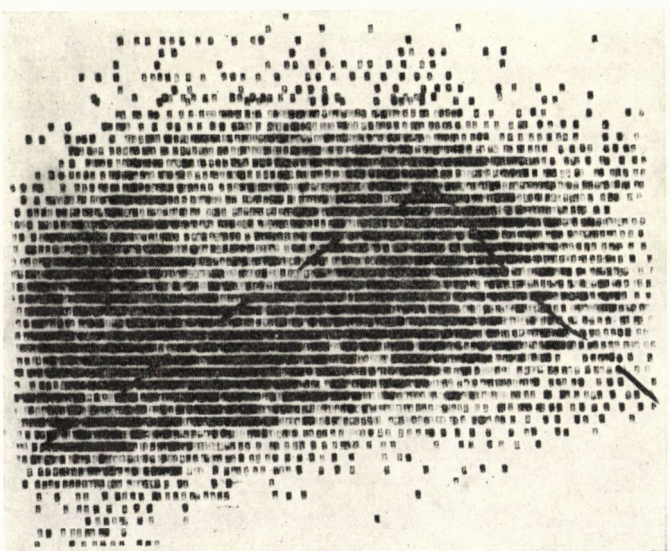

FIG. 3. Case No. 1. Hepatic scan shows a well-defined activity defect 3 cm in diameter near to the convexity of the right lobe

Since the liver was also enlarged, a hepatic scan was obtained (Fig. 3). In the area corresponding to the right lobe, near to the convex surface, there was an activity defect with a distinct borderline, measuring 3 cm in diameter. In the caudal portion there were numerous sites of unequal distribution of activity, indicating numerous smaller cysts.

The combination was diagnosed as Type III polycystic kidney, according to Potter's classification.

FIG. 4. Case No. 2. Excretion urography shows a normal pattern

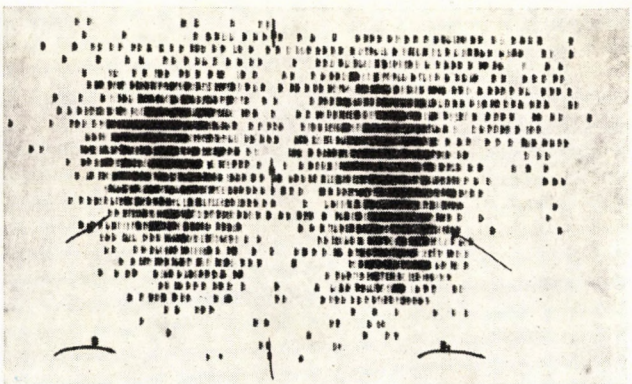

FIG. 5. Case No. 2. Scintiscan of left kidney shows grossly reduced activity in lower pole

Case No. 2. K. Cs., a 6 months old male infant was subjected to excretion urography because of pyuria resistant to selective antibiotic treatment. A normal urogram was obtained (Fig. 4). Retrograde cystography failed to reveal a reflux or any abnormality in the lower urinary tract. Then we decided to perform a renal scan (Fig. 5); both kidneys were found in their usual place, their shape and size were normal for the patient's age. The right kidney exhibited a normal activity pattern, while in the lower pole of the left kidney there was a considerable decrease of activity, indicating an impaired tubular function which was assumed to result

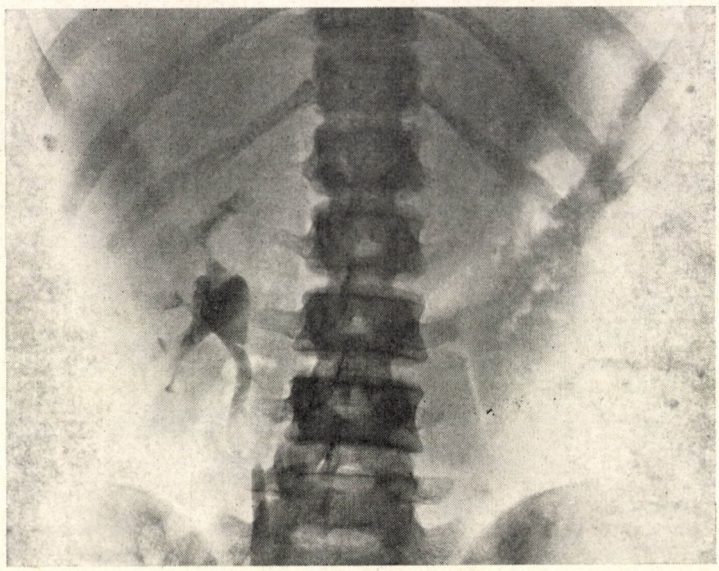

FIG. 6. Case No. 3. Excretion urography. Absence of filling on left side. Normal right kidney

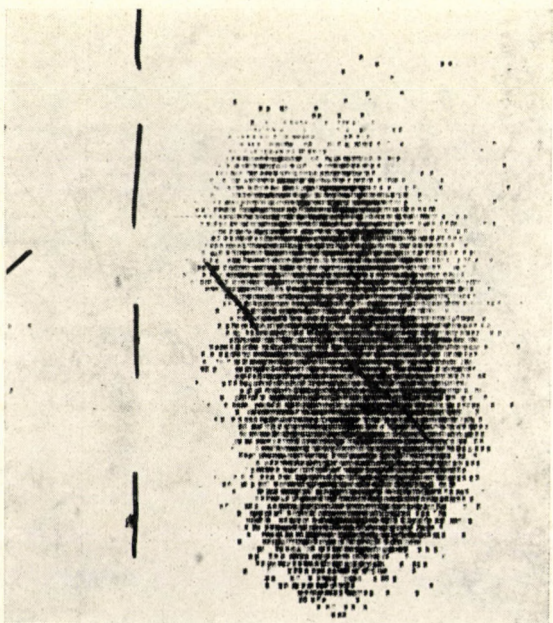

FIG. 7. Case No. 3. Scintigraphy reveals normal distribution of activity on right side and the absence of functioning renal parenchyma on left side

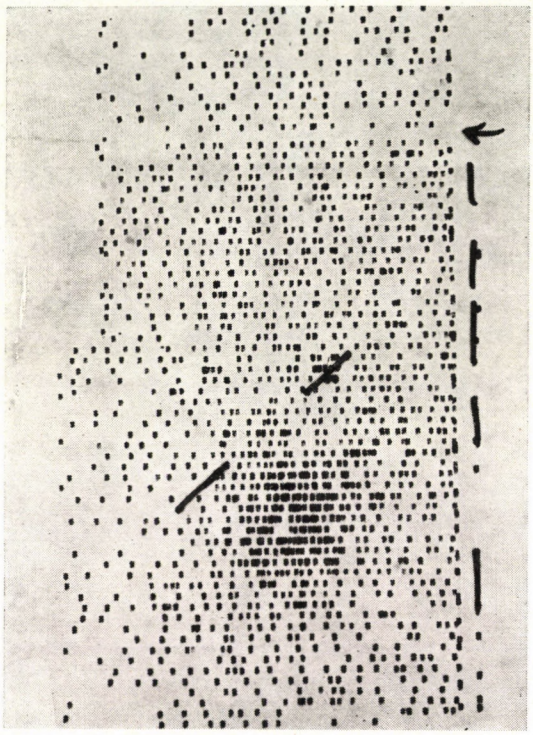

FIG. 8. Case No. 3. The second scan shows some secretory activity in the left kidney

from an inflammatory change in this part of the kidney.

Case No. 3. H. E., a 12-year-old girl was admitted because of tenderness in her left abdomen. Pyuria was found, therefore isotope renography [7, 8] and excretion urography were performed (Fig. 6). There was no filling in the left kidney, while retrograde cystography showed no abnormality. A renal scan was therefore obtained (Fig. 7) which revealed the absence of functioning renal parenchyma on the left side. A second scan was made with the recording parameters adjusted to a lower level than the activity of the contralateral normal kidney. This second scan (Fig. 8) clearly indicated that a 2×2 cm portion of the renal parenchyma was still functioning with minimal secretory activity. After removal of the left kidney, the patient's complaints subsided.

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