THE USE OF THE RENAL UPTAKE OF ^{197}Hg AS A METHOD FOR TESTING THE FUNCTIONAL VALUE OF EACH KIDNEY

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From renal mercury scanning it is obvious that mercury uptake in healthy parenchyma is high while that in diseased parenchyma is low. It seems as though the uptake level is dependent on the functional value of the renal tissue.

A significative correlation has already been found between renal uptake of mercury injected as $^{197}HgCl_2$ and clearances of inulin, PAH and Tm of PAH (*1,2*); consequently renal mercury uptake can be used as an index for the estimation of kidney function. Each kidney is measured separately by external counting, and thus kidney function is estimated for each kidney without catheterization. We have used this test over a period of 7 years in about 700 patients. The results are useful in determining the contribution of each kidney to the overall function (*2,3*).

When attention was focused on the overall fixation (i.e., the sum of both kidneys uptakes), it was noted that the overall uptake was normal in unilateral nephropathies and subnormal in bilateral nephropathies. These observations have suggested that the mercury-uptake test could show if a kidney is really sound or not in nephropathy. To test the validity of this suggestion, we systematically have measured the renal mercury uptake in patients known to have sound solitary kidney, pathological solitary kidney, unilateral and bilateral nephropathies. We will present here only the results obtained on 103 of those in whom the anatomoclinical status is known with certainty or high probability.

MATERIAL AND METHOD

The technique has been described elsewhere in detail (*2,3*), and it will be only summarized here.

Five hundred microcuries of $^{197}HgCl_2$ of high specific activity are injected intravenously. The renal activity is measured with a detector equipped with a conic probe and a double-crowned precollimator (Fig. 1). The aperture of the inferior crown is oval and can be reduced to fit closely the dimensions of the kidney. With this collimation system the crystal is placed about 60 cm above the kidney, and geometrical errors in the measurements can be reduced to a minimum. All values measured are referred to a standard representing a fraction of the injected dose. Corrections are introduced for perirenal activity seen by the detector and for kidney depth.

The cutaneous projection of the kidney is obtained by a scan in the prone position at the beginning of the fourth day after injection. The uptake measurements are made with the patient in this

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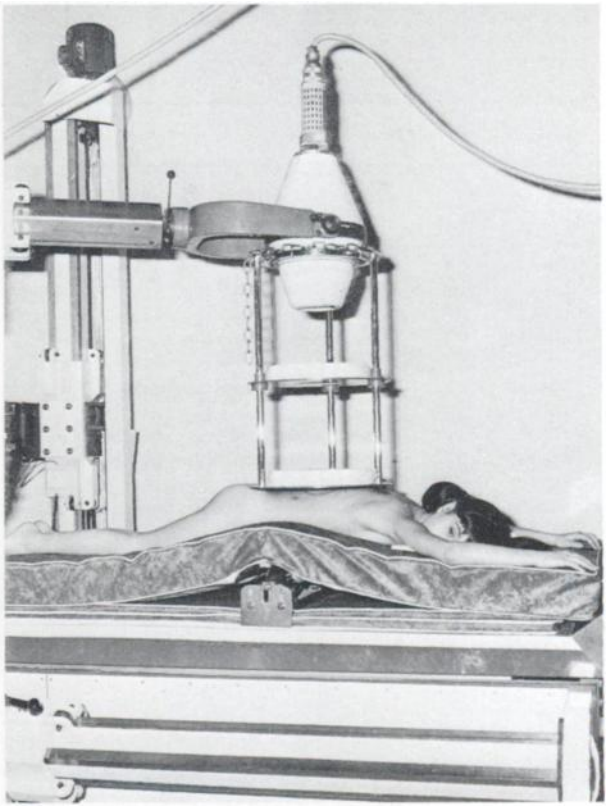

FIG. 1. Collimation system with double-crowned precollimator used for measuring renal ^{197}Hg uptake.

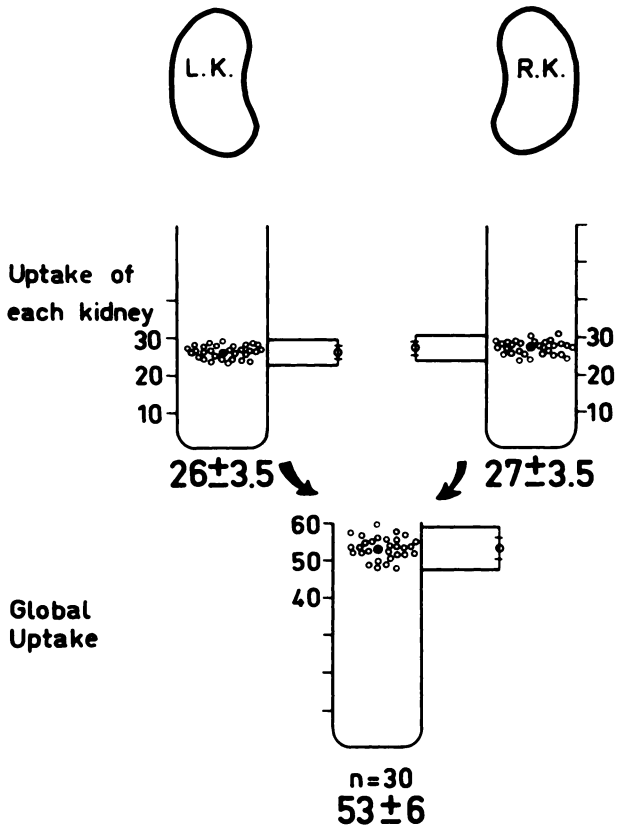

FIG. 2. Normal values of renal ^{197}Hg uptake obtained on 10 normal subjects. Normal interval is defined as mean ± 2 s.d.

prone position during the fourth, fifth and sixth days after injection. Indeed, it has already been shown that the uptake curve during this time interval can be regarded as a plateau (*2*).

To separate the patients in the following groups—sound or pathological solitary kidney, unilateral nephropathy, symmetrical or dissymmetrical bilateral nephropathy—we used clinical, radiological and histological criteria and especially followup. As a matter of fact, most of the patients have been followed more than 2 years after our test. Inulin clearance, PAH clearance and Tm of PAH, measured with bladder catheter and continuous infusion as indicated earlier (*2*), were not used as criteria for reasons discussed later. Values taken as normal are: 117 ± 28 ml/min/1.73 m² for inulin clearance, 640 ± 164 ml/min/1.73 m² for PAH clearance and 79 ± 13 mg/min for Tm of PAH, according to H. Smith (*4*).

RESULTS

Using the method described, the normal uptake, expressed in percent of the injected dose of ^{197}Hg, is 27 ± 3.5 for the right kidney and 26 ± 3.5 for the left kidney, the difference being due to liver interference. The overall uptake, i.e. the sum of the uptakes of both kidneys, is 53 ± 6 (*2*) (Fig. 2). The age of the 10 normal subjects studied varied from 8 to 66 years. The standard deviation calculated

TABLE 1. RENAL MERCURY UPTAKE IN SOUND SOLITARY KIDNEY (14 PATIENTS)

No.	Age (yr)	Diagnosis	Hg kidney uptake			Cl Inul.	Cl PAH	Tm PAH
			Right	Left	Overall			
67–166	8	RK nephrectomy for Wilm's tumor 4 years earlier		47.3	47.3	98	565	81
66–88	4	RK nephrectomy for Wilm's tumor 4 months earlier		48.5	48.5	105	613	81
65–232	17	LK nephrectomy for Wilm's tumor 16 years earlier	48.0		48.0	70	321	69
64–348	4	LK nephrectomy for Wilm's tumor 9 months earlier	48.7		48.7	86	405	73
66–145	16	LK nephrectomy for neuroblastoma 8 years earlier	57.5		57.5	99	557	80
62–87	34	RK nephrectomy for tuberculosis 4 years earlier		49.6	49.6	107	501	74
64–463	5	LK nephrectomy for Wilm's tumor 15 months earlier	59.0		59.0	109	425	61
64–174	13	LK nephrectomy for Wilm's tumor 4 years earlier	60.0		60.0	134	378	65
65–652	28	RK nephrectomy for S.H.* 18 months earlier		50.3	50.3	94	523	74
64–505	10	Unilat. congenital kidney (IVP)	52.9		52.9			
62–193	20	Unilat. congenital kidney (IVP + arterio)		47.0	47.0	142	528	
64–196	11	Unilat. congenital kidney (surgically controlled)	61.5		61.5	155	437	66
67–84	36	Unilat. congenital kidney (IVP + arterio)	48.5		48.5	92	484	101
66–484	50	Unilat. congenital kidney (IVP + arterio)	52.3		52.3	99	564	79
				Mean	52.2	107	446	75

Mercury uptake is expressed in percent of injected dose, inulin and PAH clearances in ml/min/1.73 m², Tm of PAH in mg/min.
B.P. and I.V.P. are abbreviations used in the place of blood pressure and intravenous pyelogram.
Biopsy is mentioned owing to its importance in diagnosis.
* S.H.: Segmentary hypoplasia (see Ref. 5).

TABLE 2. RENAL MERCURY UPTAKE IN PATHOLOGICAL SOLITARY KIDNEY (13 PATIENTS)

No.	Age (yr)	Diagnosis	Hg kidney uptake			Cl Inul.	Cl PAH	Tm PAH
			Right	Left	Overall			
68–485	0.6	Pyelonephritis (biopsy) of LK, RK removed 7 months earlier.		28.4	28.4			
64–241	2	RK nephrectomy and partial LK nephrectomy for Wilm's tumor 2 years earlier.		27.4	27.4			
67–191	4	Bilateral pyelonephritis, LK removed for malformative uropathy 4 years earlier.	25.2		25.2			
63–620	4.5	Hydronephrosis of LK, RK removed 4.5 years earlier.		11.0	11.0	67	346	19.5
66–470	6.5	LK nephrectomy for Wilm's tumor 6.5 years earlier, recurrence on RK.	11.5		11.5	30	110	34
64–216	12	Hypertension due to neurofibromatosis, RK moved 12 years earlier. B.P. remains high.		36.8	36.8	88	386	
63–153	14	Hypertension due to S.H.*, LK removed 14 years earlier, arteriolar lesions, B.P. remains high.	45.5		45.5	72	340	55
64–87	16	Hypertension due to bilateral S.H.* Arteriolar lesions, RK removed 16 years earlier. B.P. remains high.		9.6	9.6	12	61	10.1
62–50	77	LK hydronephrosis. RK removed for bladder tumor 4 years earlier.		34.0	34.0			
62–72	51	Pyelonephritis of RK (biopsy). Atrophic LK removed 4 years earlier.	25.0		25.0	30	172	32
67–440	41	Hypertension and drepanocytosis. Ectopic RK removed 7 years earlier, B.P. remains high.		34.0	34.0	56	225	53
66–57	52	Hypertension, pyelonephritic LK removed 1 year earlier. Diffuse arteriolar lesions, B.P. remains high.	37.9		37.9	75	411	71
63–305	48	Hypertension, solitary LK surgically controlled, arteriolar lesions (biopsy).		34.5	34.5			
				Mean	25.4			

Mercury uptake is expressed in percent of injected dose, inulin and PAH clearances in ml/min/1.73 m^2, Tm of PAH in mg/min.
B.P. and I.V.P. are abbreviations used in the place of blood pressure and intravenous pyelogram.
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for the 30 measurements made is 1.85 and 1.66 for the right and left kidneys, respectively. The relative standard deviation, the variation coefficient [(s.d./mean) 100] is 7% and 6.5%, respectively.

The reproducibility of the method has been tested in two different ways. The measurement was repeated 10 times on the same patient. Between each measurement the patient moved off the table and the standard was measured. The relative standard deviation of these 10 measurements is 3.3%. On two normal subjects the uptake measurement was repeated at intervals of 1 month and 1 year, and the maximum difference observed was 7% (*2*).

To test the feasibility of the method we compared once the uptake values found *in vivo* with values found *in vitro* measured on exposed kidneys. *In vivo* uptake was 17.0 for the right side and 18.0 for the left side. *In vitro* uptake was found to be 14.0 for each kidney.

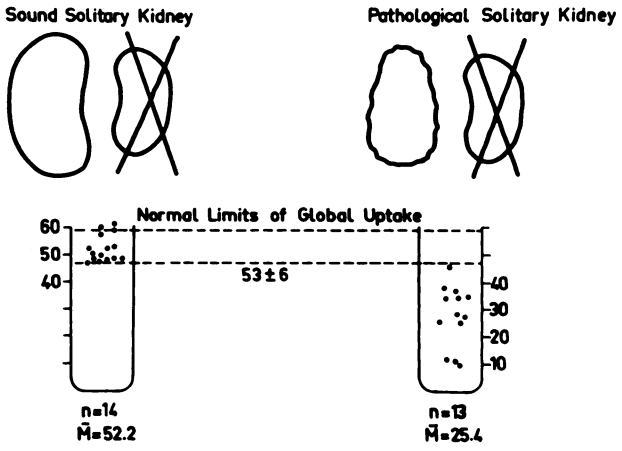

FIG. 3. Renal ^{197}Hg uptake of solitary kidneys in 27 subjects. When there is sound solitary kidney (14 patients), mean value is normal and all values are over 47.0. When there is pathological solitary kidney (13 patients), all values are under 47.0.

Of the 103 patients studied:

1. 27 had solitary kidney (Fig. 3). In the 14 cases with a sound solitary kidney, the mean value of uptake was 52.2, i.e. double the value of a single normal kidney. All values are equal or greater than 47.0, which is the inferior limit of normal overall uptake (Table 1). In the 13 cases with a diseased solitary kidney, the uptake was low, normal or high compared with the value of one kidney, but always lower than 47.0 (Table 2).

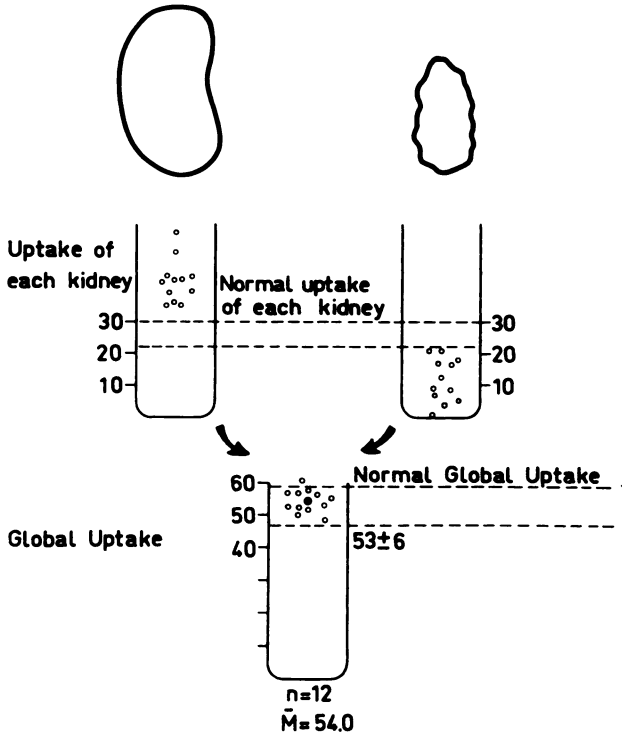

FIG. 4. Renal ^{197}Hg uptake in unilateral nephropathies. For 12 patients hyperfixation of sound kidney compensates hypofixation of pathological one.

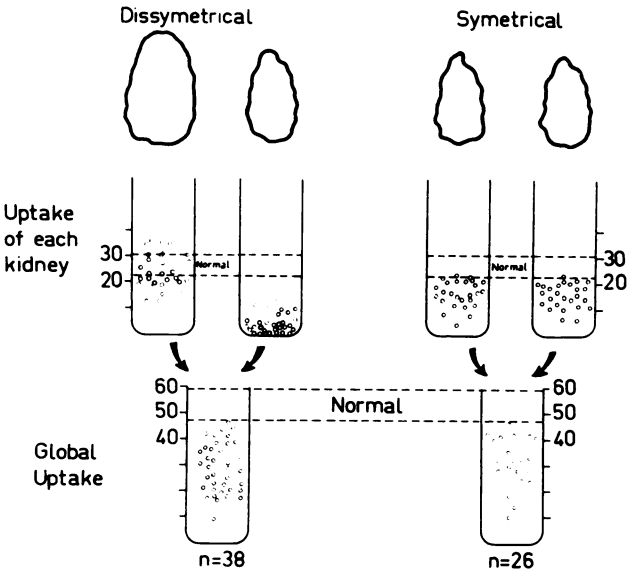

FIG. 5. Renal ^{197}Hg uptake in bilateral nephropathies in 64 subjects. In all cases overall uptake is under normal. In some dissymmetrical nephropathies less pathological kidney exhibits hyperfixation but it does not compensate completely hypofixation of other side.

2. 12 had a strictly unilateral nephropathy (Fig. 4, Table 3). The uptake of the diseased kidney was low, while that of the sound kidney was high. For all these patients the overall uptake was normal, the mean value being 54.0. The hyperfixation of the sound kidney compensates for the hypofixation of the pathological kidney.

3. 64 had a bilateral nephropathy (Fig. 5). In 26 cases the diagnosis implicated a diffuse distribution of the lesions; uptake was low on both sides and approximately equal. The overall fixation was less than 47.0 for all patients (Table 4). In 38 cases the distribution of the lesions was evidently dissymmetrical, one kidney being more affected than the other. The uptake of the more pathological kidney was always low, while that of the other was either low, normal or high, but in all cases the overall uptake was less than 47.0 (Table 5).

If we focus our attention on overall uptake, the results can be expressed in the following manner:

In unilateral nephropathies (and when there is a solitary sound kidney which can be considered as a special case of unilateral nephropathy), the overall uptake is normal, i.e. $\geqq 47.0$.

In bilateral nephropathies (and when there is a solitary pathological kidney which can be seen as a special case in this group), the overall uptake is less than normal, i.e. < 47.0.

DISCUSSION

For many years the only technique capable of giving a quantitative evaluation of the functional value of each kidney has been the measurement of clearances after ureteral catheterization. But this technique has many inconveniences; it is unpleasant for the patient, it can be a source of infection and it suffers from the lack of precision common to all clearance methods, their relative standard deviation being about 25% (*4*). Due to these disadvantages, this method cannot be used as a routine test. Attempts have been made to obtain the value of PAH clearances of each kidney by external counting. In 1963 Taplin described a method using the slope of the second segment of the renogram curves (*7*). Recently an ingenious technique was presented by Bianchi using compression of the ureters (*8*).

The estimation of the functional value of each kidney can be attained in a very different way by the measurement of the mercury renal uptake. This

TABLE 3. RENAL MERCURY UPTAKE IN UNILATERAL NEPHROPATHIES (12 PATIENTS)

No.	Age (yr)	Diagnosis	Hg kidney uptake			Cl Inul.	Cl PAH	Tm PAH
			Right	Left	Overall			
67–668	41	Hypertension with atrophic RK, cured after RK nephrectomy.	0.0	57.4	57.4	92	430	55
62–87	30	RK tuberculosis. Normal renal function after nephrectomy.	17.0	39.0	56.0	142	603	
66–390	11	Hypertension due to S.H.* of LK cured after partial LK nephrectomy.	35.0	16.5	51.5	98	485	76
62–162	10	Hypertension cured by removal of a small arterial aneurysm of LK. Uptake measured 2 years after partial LK nephrectomy.	35.0	18.0	53.0	111	525	73
67–178	6	Anomaly of the left pyelo-ureteral junction.	43.9	8.4	52.3			
65–652	26	Hypertension with S.H.* of RK cured after RK nephrectomy.	4.0	44.0	48.0	65	318	58
63–621	14	Malformative uropathy with dysplasia of RK.	7.0	43.0	50.0	151	698	106
67–510	24	Hypertension with atrophic LK (chronic pyelonephritis) cured after LK nephrectomy.	51.1	5.3	56.4			
68–372	18	Hypertension with atrophic LK cured after LK nephrectomy.	42.0	12.7	54.7	123	471	73
65–579	33	Hypertension with atrophic RK (chronic pyelonephritis) cured after RK nephrectomy.	21.0	39.5	60.5	99	344	62
62–284	35	Chronic pyelonephritis of RK (biopsy).	9.2	42.8	52.0	109	618	66
66–687	25	Thrombosis of inferior branch of LK artery.	35.5	21.0	56.5	121	707	84
				Mean	54.0	107	501	72

Mercury uptake is expressed in percent of injected dose, inulin and PAH clearances in ml/min/1.73 m^2, Tm of PAH in mg/min.
B.P. and I.V.P. are abbreviations used in the place of blood pressure and intravenous pyelogram.
Biopsy is mentioned owing to its importance in diagnosis.
* S.H.: Segmentary hypoplasia (see Ref. 5).

TABLE 4. RENAL MERCURY UPTAKE IN SYMMETRICAL NEPHROPATHIES (26 PATIENTS)

No.	Age (yr)	Diagnosis	Hg kidney uptake			Cl Inul.	Cl PAH	Tm PAH
			Right	Left	Overall			
64–407	1.5	Nephrotic syndrome	15.0	15.0	30.0			
62–148	3	Nephrotic syndrome	23.0	23.0	46.0	131	579	
62–26	5	Hypothyroidism, insufficient treatment.	21.0	21.0	42.0	65		
64–206	6	Nephrotic syndrome	15.5	12.5	28.0	90	446	68
68–270	6	Oxalosis with nephrocalcinosis	16.1	15.4	31.5	58	268	48
65–165	7	Glycogenosis	11.5	11.5	23.0	47	188	23
63–552	14	Wilson's disease with tubular lesions	22.5	18.0	40.5	101	328	38
62–183	33	Essential hypertension	17.0	18.0	35.0	81	265	
62–44	26	Essential hypertension	8.0	10.0	18.0	36		
62–222	36	Essential hypertension	14.0	10.5	24.5	23	125	
62–385	38	Nephrotic syndrome	13.5	14.0	27.5	62		
65–17	41	Essential hypertension	16.5	14.5	31.0			
62–239	43	Essential hypertension	18.5	18.0	36.5	52	292	
65–355	43	Essential hypertension	11.5	11.0	22.5			
62–3	43	Essential hypertension	20.0	21.0	41.0	143		
68–102	43	Essential hypertension	19.4	19.5	38.9			
64–486	46	Essential hypertension	7.5	6.5	14.0			
64–136	46	Essential hypertension	20.5	19.0	39.5	89	432	83
67–855	47	Essential hypertension	20.8	21.1	41.9			
63–551	49	Essential hypertension	16.0	16.5	32.5	60	316	49
64–313	56	Essential hypertension	15.2	16.5	31.7		443	
65–534	56	Hypokaliemic nephropathy	4.0	6.0	10.0	40	172	
65–534	57	Hypokaliemic nephropathy (same patient)	14.0	14.0	28.0	95	414	
65–534	58	Hypokaliemic nephropathy (same patient)	11.0	12.5	23.5	64	284	59
64–500	60	Nephrotic syndrome	22.0	20.0	42.0			
62–254	65	Essential hypertension	21.0	19.5	40.5	95	336	

Mercury uptake is expressed in percent of injected dose, inulin and PAH clearances in ml/min/1.73 m^2, Tm of PAH in mg/min.
B.P. and I.V.P. are abbreviations used in the place of blood pressure and intravenous pyelogram.
Biopsy is mentioned owing to its importance in diagnosis.

method does not study the excretory function as do clearance methods; instead it uses the peculiar power of the renal parenchyma to take up heavy metals. This test has been shown to reflect the functional value of the kidneys more accurately than do clearance methods (*1–3*). This test is simple, well accepted by patients and relatively accurate, the variation coefficient being only 7%. It can be repeated on the same patient, the kidney radiation dose being about 25 rads (*2*) and the load of stable mercury less than 5 μg (*2*), and can be considered as a useful routine technique. Mercury renal uptake can be helpful in evaluating hypofunction as well as in measuring the degree of development of hyperfunction in compensatory hypertrophy (*3*). The results presented here indicate that the compensatory hyperfixation is maximum only in the sound kidney. In the diseased kidney, if a compensatory hyperfixation does exist, it does not reach maximum values. Logically it would be possible to make the following deduction in the case of nephropathies:

If overall uptake is normal, one kidney is normal.

If overall uptake is less than normal, both kidneys are pathological. Mercury uptake could then be used to distinguish between unilateral nephropathies. On some patients uptake was measured before and after nephrectomy, and it was possible to follow for each one the development of the compensatory hypertrophy. In unilateral nephropathies, after the nephrectomy of the diseased kidney, the sound kidney uptake increases and the value of overall uptake does not change significantly (Fig. 6). When both kidneys are pathological, the uptake is low before nephrectomy of one; it remains low after, as if the development of the compensatory hyperfixation of a diseased kidney was limited (Fig. 7). These results confirm the deductions established by statistical study of the data. They indicate also that it may be possible to predict before nephrectomy approximately what value the remaining kidney will reach after nephrectomy. The usefulness of this information seems obvious in deciding if surgery is indicated or not. A systematic study of renal mercury uptake is undertaken in renovascular hypertension and in obstructive uropathies before and after surgery. It will indicate to us if this test can be considered a criterion to select patients for surgery.

Former results obtained on adults and older children suggested that the normal uptake values could be the same through life. We are not able to give the normal values for each age of childhood for ethical reasons and difficulties in showing normality of the renal function. However, in three children about 2 years old with normal kidney function we found a lower uptake than in adults. For four others aged 5–11 years old the uptake is within normal limits for adults. Our results are too scarce to define the age at which the level of normal uptake starts to be lower than in adults, but they indicate that for

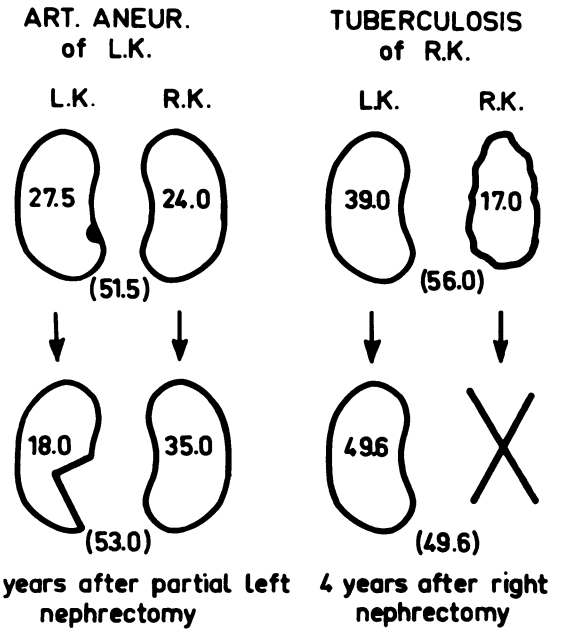

FIG. 6. Compensatory hypertrophy developed in sound kidney. Overall uptake remains normal after surgery, hyperfixation of normal kidney compensates deficit due to surgery.

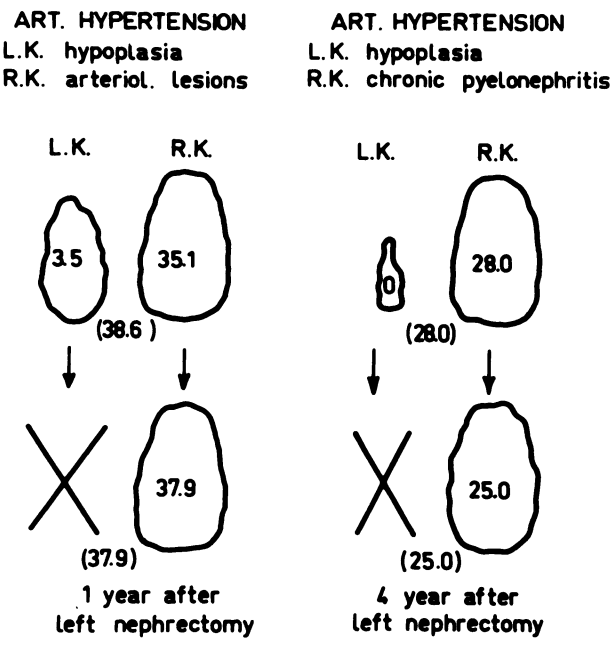

FIG. 7. Compensatory hypertrophy developed in pathological kidney. Overall uptake was low before surgery and remains low afterwards.

TABLE 5. RENAL MERCURY UPTAKE IN ASYMMETRICAL BILATERAL NEPHROPATHIES (38 PATIENTS)

No.	Age (yr)	Diagnosis	Hg kidney uptake			Cl Inul.	Cl PAH	Tm PAH
			Right	Left	Overall			
68–354	9	Small LK, chronic pyelonephritic RK (biopsy).	20.1	10.1	30.2	86	345	57
67–587	14	Hypertension with bilateral S.H.*	2.9	19.5	22.4			
68–80	1	Bilateral malformative uropathy.	12.0	5.2	17.2			
67–669	2	Bilateral malformative uropathy.	17.4	2.0	19.4			
68–332	9	Small RK, chronic pyelonephritic LK.	10.0	22.7	32.7	64	282	61
67–804	6	Bilateral lithiasis, multiple pyelolithotomies.	3.3	29.0	32.3			
67–634	24	Bilateral pyelonephritis (mainly RK).	4.5	20.4	24.9	24	224	30
67–414	36	Hypertension, chronic pyelonephritis of RK (biopsy) with diffuse arteriolar lesions.	2.8	27.8	30.6	58	227	45
67–856	41	Hypertension with atrophic LK, diffuse arteriolar lesions on biopsy.	30.1	7.9	38.0	84	295	46
62–207	59	Voluminous cyst of LK, chronic pyelonephritis of RK.	16.0	19.0	35.0	107	386	
62–207	64	Same patient 5 years after removal of the cyst.	15.9	25.4	41.3	78	329	59
65–627	5	Hypertension, silent LK, no compensatory enlargement RK.	18.0	0.0	18.0	38	163	30
65–597	58	Silent RK, chronic pyelonephritis of LK.	0.0	9.5	9.5	76	154	20
64–299	67	Silent lithiasic LK, cancer of RK.	20.0	0.0	20.0	56	290	35
62–73	51	Hypertension, bilateral chronic, pyelonephritis (mainly LK) (biopsy of LK).	15.0	3.0	18.0	26		
62–36	47	Hypertension, bilateral chronic pyelonephritis + lithiasis (mainly LK) (biopsy of LK).	30.0	11.0	41.0	184		
67–636	33	Severe hypertension with LK tuberculosis.	17.6	8.6	26.2			
67–353	17	Bilateral oligomeganephronic hypoplasia† (biopsy).	2.0	18.4	20.4	47	231	47
62–72	47	Hypertension, silent LK, chronic pyelonephritis of RK (biopsy).	28.0	0.0	28.0	64		
63–238	14	Bilateral lithiasis, silent LK.	21.2	0.0	21.2	67	481	75
68–407	56	Hypertension + diabetes mellitus, atrophic LK, chronic pyelonephritic RK.	27.0	7.5	34.5			
68–406	57	Hypertension + diabetes mellitus, bilateral renal artery stenosis.	23.5	14.0	37.5			
67–511	11	Hypertension with bilateral S.H.* (biopsy).	9.8	12.6	22.4			
64–149	11	Bilateral oligomeganephronic hypoplasia† (biopsy).	16.0	4.5	20.5	54	188	28
62–275	38	Hypertension, polycystic kidneys (mainly LK).	21.0	10.5	31.5	71	392	
65–564	2	Bilateral partial nephrectomy for bilateral Wilm's tumor.	5.5	11.5	17.0			
64–513	11	Hypertension with atrophic RK and diffuse arterial lesions on biopsy.	6.0	23.0	29.0	147	299	13
67–543	63	Tuberculosis of RK, no compensatory enlargement of LK.	3.9	12.5	16.4	33		
66–57	51	Hypertension, pyelonephritic and hypoplasic LK. Diffuse arteriolar lesions (biopsy).	35.1	3.5	38.6	124	417	57
68–353	5	Atrophic RK, chronic pyelonephritic LK.	2.0	21.0	23.0			
63–37	9	Hypertension with S.H.* of LK. Arteriolar lesions of RK (biopsy).	34.4	0.0	34.4			
68–499	12	Hypertension, S.H.* of RK (biopsy), bilateral lithiasis.	0.0	43.2	43.2			
67–148	2.5	Lithiasis and chronic pyelonephritis of LK on biopsy, no compensatory enlargement of RK.	34.6	3.9	38.5			
66–708	32	Silent LK, hydronephrotic RK with anomaly of pyelo-ureteral junction.	38.9	2.8	41.7			
67–711	0.6	Silent RK, reflux on left side.	4.5	31.4	35.9			
68–400	4	Radiological abnormalities of the cavities of both kidneys.	16.1	30.3	46.4			
68–128	28	Voluminous hydronephrosis of RK, ureteritis of LK.	1.5	34.7	36.2			
67–388	4	Hypoplasic RK, no compensatory enlargement of LK.	8.5	35.3	43.8	83	400	85

Mercury uptake is expressed in percent of injected dose, inulin and PAH clearances in ml/min/1.73 m^2, Tm of PAH in mg/min.

B.P. and I.V.P. are abbreviations used in the place of blood pressure and intravenous pyelogram.

Biopsy is mentioned owing to its importance in diagnosis.

* S.H.: Segmentary hypoplasia (see Ref. 5).

† Oligomeganephronic hypoplasia (see Ref. 6).

children under 4 or 5 years data cannot be interpreted as it is for older children.

On most of the patients the inulin and PAH clearance and Tm of PAH were measured. In sound solitary kidneys, inulin clearance and Tm of PAH are normal, with mean values of 92% and 94% of normal. The clearance of PAH is slightly low with a mean value of 70% of normal. These data are in agreement with those found in four patients by Donadio (*9*). They disagree with the case of Weiss and Chasis reported by Smith (*4*) which had normal PAH clearance. They also disagree with the nine patients of Maluf (*10*) who found low inulin clearance, normal PAH clearance and high Tm of PAH. Up to now it is not possible to find in the literature the values which could be considered typical of sound solitary kidneys. The same confused situation is observed in unilateral nephropathies. In our group inulin clearance and Tm of PAH are normal, with 92% and 91% of the normal, respectively (Table 4). The PAH clearance is at the inferior limit of normal values with 78% of normal, as in the case reported by Weiss and Chasis (*4*). Reported cases of proved or very probable unilateral nephropathies are very rare because of the difficulty in knowing that one kidney is sound. The lack of typical formula of clearance values for anatomical situations like sound solitary kidney and unilateral renal disease explain why we did not use clearance values among the criteria selected. The highest value was given to the followup. In the 12 patients diagnosed as unilateral nephropathies, 9 were followed for more than 2 years after uptake measurement and two others for more than 1 year. The 14 sound solitary kidneys were followed more than 2 years after our test. With a long period of followup the chances of error of diagnosis are very much reduced. The value of the other criteria chosen is different for each patient. We did not give value to a normal biopsy which represents only a small part of the parenchyma but the finding of arteriolar lesions at the biopsy was considered as a sign of bilateral lesions.

The mercury renal uptake test can be useful whenever it is necessary to know quantitatively the functional value of each kidney. The main clinical indications for this test could be expressed as follows (*7*):

1. In the study of arterial hypertensions. If the hypertension is due to one kidney only, uptake is low on this side. This is the case in arterial stenosis and in unilateral parenchymal lesions (tuberculosis, pyelonephritis, etc.) and segmentary hypoplasia (*5*), but not in arterial aneurysm where we found normal uptake values. In essential hypertension the uptake is normal on each side or is symmetrically diminished.

2. In the functional study of the kidneys preceding surgery, mercury uptake gives the remaining functional value of the pathological kidney and indicates whether the other kidney is sound or not.

3. When other quantitative tests cannot be used, e.g. in the case of infection of the lower urinary tract; also when there is a surgical deviation of the ureter.

4. When it is necessary to verify the efficiency of a medical or surgical treatment.

This test is simple, accurate and reproducible and it is well accepted by the patients. It can be used profitably each time the functional value of each kidney in quantitative terms is desired.

SUMMARY

The renal uptake of mercury depends closely on renal function. The uptake value of ^{197}Hg, measured by external counting, allows the quantitative estimation of the functional value of each kidney.

With normal kidneys the level of uptake of the right and left kidneys, respectively, is 27.0 ± 3.5% and 26.0 ± 3.5 of the injected dose; the global uptake is 53 ± 6%.

Mercury uptake has been measured in different kidney conditions: (1) In the case of a solitary kidney, the uptake is equal to or greater than 47.0 when the kidney is sound and less than 47.0 when the kidney is pathological. (2) When there is an unilateral nephropathy, the uptake of the sound kidney is greater than normal, compensating for the hypofixation of the pathological side, and global uptake is normal i.e. ≧ 47.0. (3) When there is a bilateral nephropathy, if the lesions are symmetrical, uptake is equally low in both kidneys. If the lesions are dissymmetrical the less affected kidney will have a higher uptake than the other. But in both cases the global uptake is always less than normal.

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REFERENCES

1. RAYNAUD, C., DESGREZ, A. AND KELLERSHOHN, C.: Exploration rénale à l'aide de la néohydrine et du bichlorure de Hg marqués aux mercures radioactifs ^{197}Hg et ^{203}Hg. In *Radioaktive Isotopen in Klinik und Forschung,* Band V, Urban und Schwarzenberg, Munich/Berlin, 1963, p. 317.

2. RAYNAUD, C., DESGREZ, A. AND KELLERSHOHN, C.: Measurement of renal mercury uptake by external counting: separate functional testing of each kidney. *J. Urol.* **99**:248, 1968.

3. RAYNAUD, C., SCHOUTENS, A. AND ROYER, P.: Intérêt de la mesure du taux de la fixation rénale du Hg dans l'étude de l'hypertropie rénale compensatrice chez l'homme. *Néphron* **5**:300, 1968.

4. SMITH, H. W.: *The Kidney—Structure and Function in Health and Disease,* Oxford University Press, New York, 1955, p. 544.

5. HABIB, R., COURTECUISSE, V., EHRENSPERGER, J. AND ROYER, P.: Hypoplasie segmentaire du rein avec hypertension artérielle chez l'enfant. *Ann. Ped. Sem. Hop. Paris* **16**: 954, 1965.

6. ROYER, P., HABIB, R. ET LECLERC, F.: L'hypoplasie rénale bilatérale avec oligoméganéphronie. In *Proc. Third Intern. Cong. Nephrol.*, vol. 2, Karger, Basel/New York, 1967, p. 251.

7. TAPLIN, G. V., DORE, E. K. AND JOHNSON, D. E.: The quantitative radiorenogram for total and differential renal blood flow measurements. *J. Nucl. Med.* **4**:404, 1963.

8. BIANCHI, C., COLI, A., GIANNOTTI, P. AND LENARS, A.: A new approach to the measurement of divided renal plasma flow by ^{131}Hippuran and external counting in humans. In *Radioaktive Isotopen in Klinik und Forschung,* Band VI, Urban und Schwarzenberg, Munich/Berlin, 1965, p. 136.

9. DONADIO, J. V., JR., FARMER, C. D., HUNT, J. C., TAUXE, W. N., HALLENBECK, C. A. AND SHORTER, R. G.: Renal function in donors and recipients of renal allotransplantation. Radioisotopic measurements. *Ann. Intern. Med.* **66**:105, 1967.

10. MALUF, N. S. R., FORD, R. V. AND SPURR, C. S.: Physiology of the human solitary kidney. *J. Urol.* **78**:117, 1957.

11. RAYNAUD, C.: Indications de la mesure du taux de la fixation rénale du Hg. In *Actualités Néphrologiques à l'Hôpital Neckar, Flammarion, Paris,* 1967, p. 297.

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