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Chronic Urinary Schistosomiasis and its Relationship to Hypertensions

BY

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I wished to discover whether a kidney is affected by ovideposition or by a secondary pyelonephritis in urinary schistosomiasis, and found that ova in its tissue was of no importance, as they were never found in any of the biopsy material studied. On the other hand, it is possible that because of secondary ascending infection, pyelonephritis ensues and so hypertension. Unfortunately I cannot give the answer to this problem, as hypertension is very common in practice. There is a considerable amount of evidence to-day to show that pyelonephritis occurs in non-schistosomal territories as well. Yet in an endemic area the possibility cannot be dismissed.

Patients Admitted with Ureteric Pain

Two classes of case were selected for investigation. The first included those patients admitted because of schistosomal ureteric or renal colic and the second group those who were referred to me because of hypertension.

The blood pressure was determined in all patients admitted with ureteric colic or pain due to ureteric disease and who showed disease in the ureter on pyelography. An intravenous pyelogram was performed on each and, where possible, cystoscopy and retrograde pyelography, and in a number of instances renal biopsy as well. Urine culture and a blood urea were also done when possible. The blood pressure was taken daily and most of the patients remained in hospital for at least 10 days. Only the later blood pressure readings were accepted, as these are probably the more accurate.

In the majority of these cases the urine specimens contain large numbers of leucocytes and red cells are generally much less in evidence, with terminal spined ova few or absent. However, the ova can readily be found, when the urine is free of them, in rectal biopsy material or on cystoscopy, when gross bilharzial changes can be recognised. More often than not a coliform organism can be cultured.

Results

There were 27 cases with bilateral or unilateral hydronephrosis and 15 of them showed hypertension, usually of a mild to moderate degree. As already mentioned, what we have been accustomed to refer to as hydronephrosis may in fact be pyelectasia, the result of chronic pyelonephritis. There is indeed a great similarity between the degree of calyceal dilatation found in schistosomal disease and that described by Rosenheim (1963) in chronic pyelonephritis. Some of our cases labelled as having hydronephrosis may have chronic pyelonephritis with pyelectasia; and whereas the latter affects the renal tissue locally, in schistosomal disease it is diffuse, as almost invariably a needle biopsy of renal tissue shows the features of chronic pyelonephritis (Figs. 1, 2 and 3).

Table I summarises the results of this investigation.

Renal biopsies were performed on two of those with normal blood pressures. One showed no abnormality and the other pyelonephritis. All 15 cases with blood pressure had mild to moderate hydronephrosis; three were unilateral. A renal biopsy performed on four cases indicated pyelonephritic changes. All were youngish in the 20 to 45 age group, but mostly in the thirties. This might indicate that where hydronephrosis is present even unilaterally or mildly in schistosomiasis, as in other diseases, hypertension may ensue.

There were 11 cases with unilateral or bilateral ureteric disease such as dilatation or stricture, but without hydronephrosis. Six of these had hypertension, the blood pressure readings being:

(1) 170/90.
(2) 145/105.
(3) 160/95.
(4) 170/120; after bilateral ureteric meatotomy it dropped to normal 140/80.
(5) 150/110; after bilateral ureteric meatotomy it rose to 160/115.
(6) 190/110.

Thus hypertension may occur in schistosomal disease without hydronephrosis.

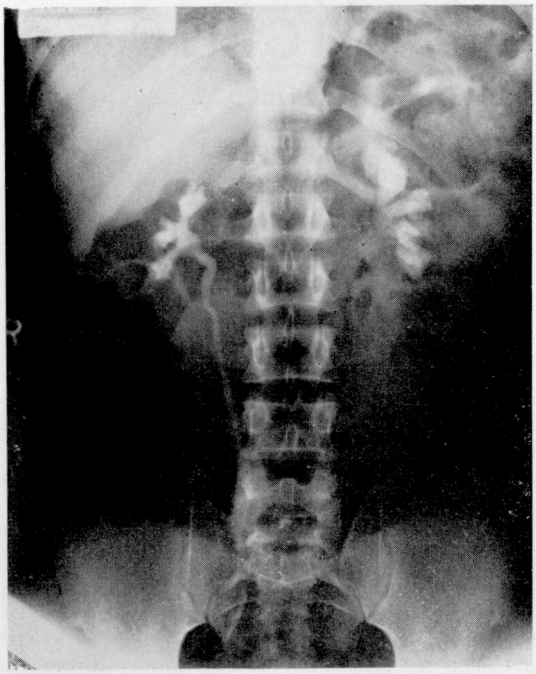

Fig. 1—Left-sided hydronephrosis in patient with urinary schistosomiasis. Patient had moderate hypertension.

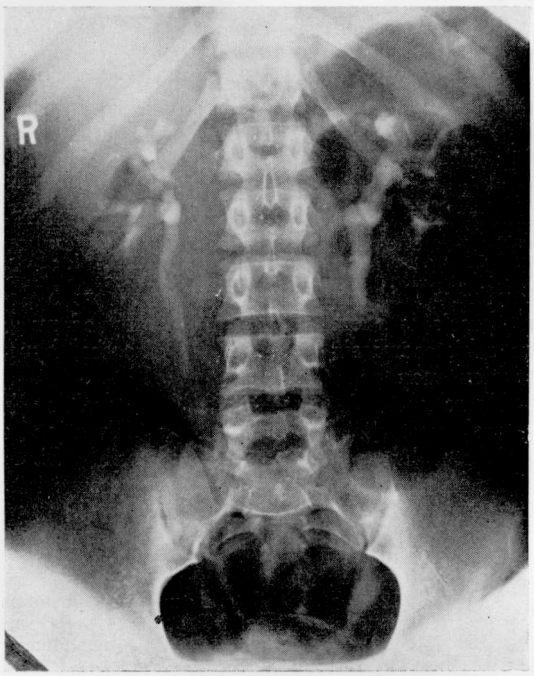

Fig. 2—Hypertension in a patient with early bilateral pelvic dilatation. Note also the dilatation of the lower third of the left ureter.

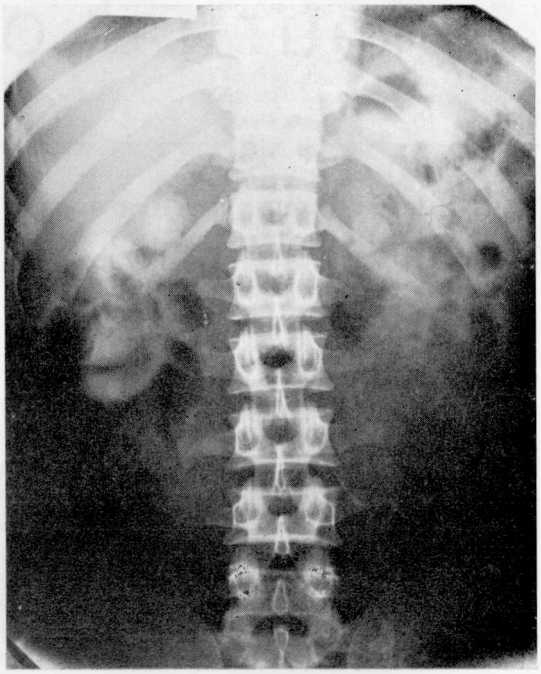

Fig. 3—Example of gross hydronephrosis.

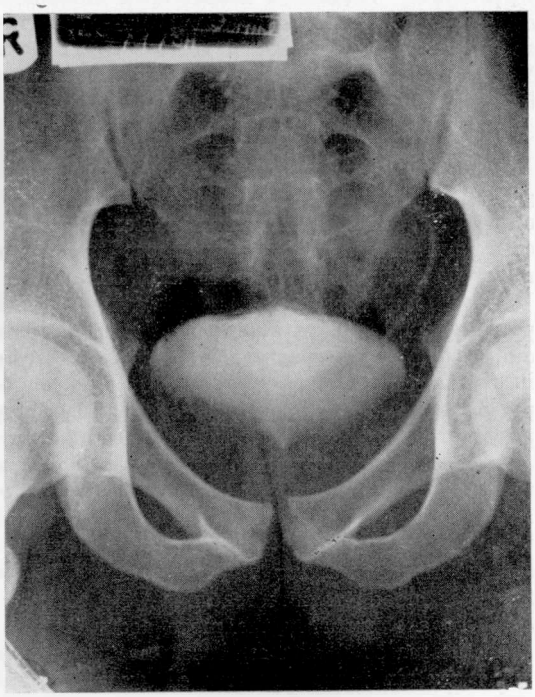

Fig. 4—Calcified bladder with persistent filling of left ureter. Patient had a moderate degree of hypertension.

Table I

CASES OF HYDRONEPHROSIS SHOWING LEVELS OF BLOOD PRESSURE

Case	Age	Hydronephrosis		Ureter	Blood Pressure	Renal Biopsy	Blood Urea	Urine Deposits	Culture
		Bilateral	Unilateral						
1	34	x		dilated	155/100			Leucocytes	
2	35	x			160/95	Interstitial fibrosis. Features suggest pyelonephritis. Bladder capacity 540 ml.	23	+	
3	22		x		165/95		25	++	
4	29		x		165/90		24		Lactose fermenting.
5	40	x			175/110			++	Coliform organisms.
6	23	x			155/120				
7	35	x		dilated	160/115 115/79 after bilateral meatotomy				Sterile.
8	35	x		dilated	140/100		36		
9	36	x			150/105		58	+++	Coliform organism.
10	24	x		one dilated	140/100		52		Lactose fermenting coliform organisms.
11	22		x right early		170/100	Interstitial fibrosis with round cell infiltration and chronic pyelonephritis. Bladder capacity 550 ml.			Sterile.
12	35				150/112	Chronic pyelonephritis.			
13	35	x early			155/100			+++	Coliform organisms.
14	35	x			170/90	Chronic pyelonephritis.		+	
15	35	x			140/110		16	—	Sterile.

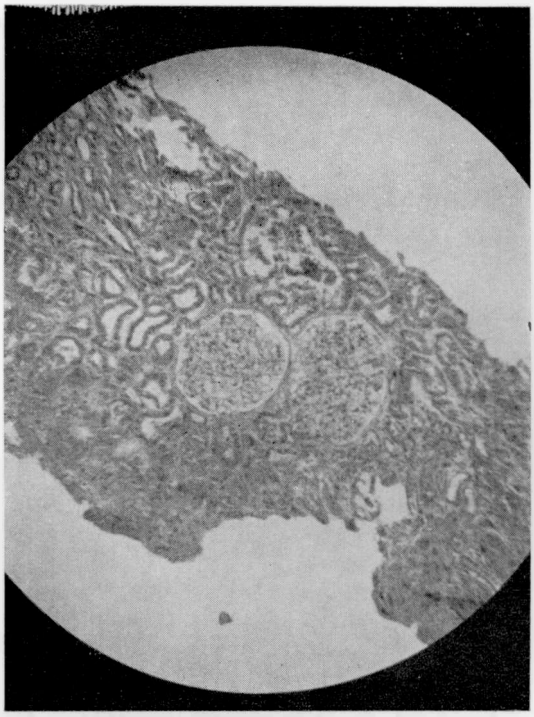

Fig. 5—Renal biopsy. Thickening of Bowman's capsule with early glomerular changes.

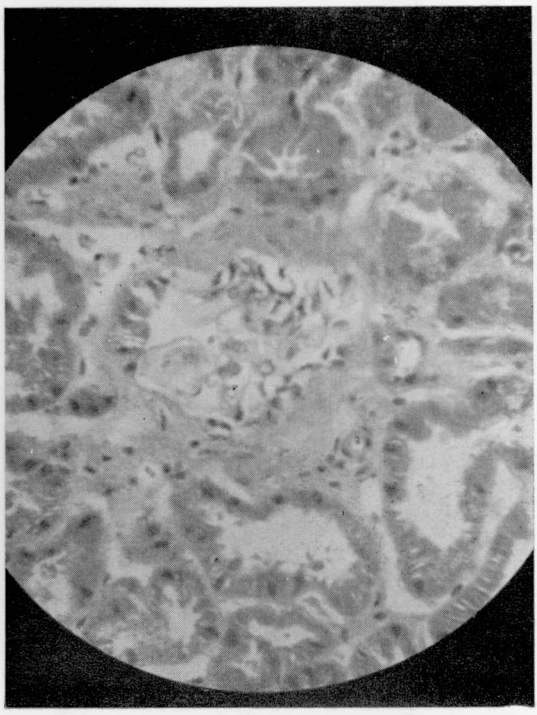

Fig. 6—Renal biopsy. More marked capsular changes with atrophy of glomeruli.

The bladder was calcified in four of these six patients, but calcification of the bladder and affected ureters may be encountered without hypertension (Fig. 4). Thus we encounter some degree of elevation of the blood pressures in association with schistosomal disease, not only when complicated by hydronephrosis, but also with unilateral or bilateral disease of the ureters or with an affected bladder with a normal pyelogram. Chronic pyelonephritis seems to be a result of long-standing schistosomiasis and this may be one of the reasons for the hypertension.

I performed a renal needle biopsy on nine subjects admitted because of pain in the abdomen. In eight of them the pathologist found chronic pyelonephritis and one biopsy was returned as being normal. The usual histological changes included round cell or leucocytic infiltration of the interstitial tissue, together with sclerotic changes in the glomeruli. In six there was mild to moderate hydronephrosis on one or both sides, in two of which the blood pressure was normal. In the other three it was elevated in two and normal in one. In the one with a normal pressure the biopsy report was normal. In the other two both had ureteric disease, but

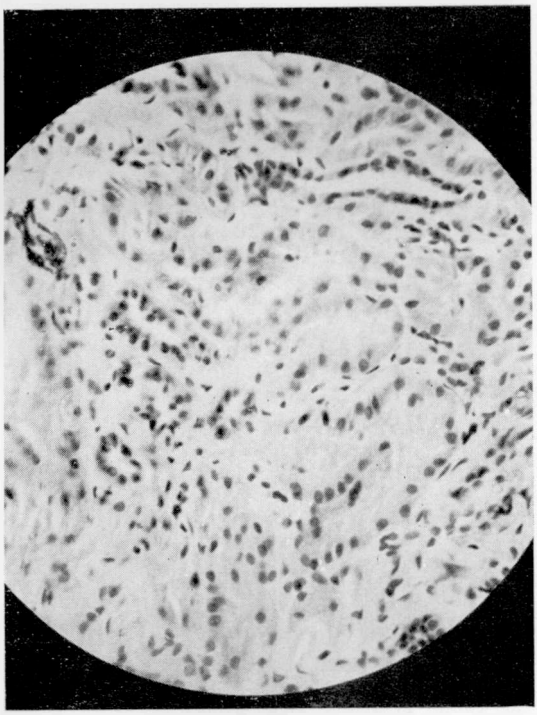

Fig. 7—Renal biopsy. Interstitial fibrosis. Tubules blocked with amorphous debris.

without calyceal dilatation, and in both of them the blood pressure was elevated (Figs. 5, 6, 7, 8 and 9).

Thus these findings would point to an inflammatory change occurring in the renal parenchyma possibly affecting the juxta-glomerular body in some of the subjects affected with chronic vesical and ureteric schistosomiasis and so leading to the development of hypertension.

It is also possible that hypertension can occur in the absence of obvious ureteric disease or of dilatation of the pelvis and its calyces. One such patient, an African aged 30, complained of pains in the epigastrium and of backache. The lowest blood pressure recorded was 160/90 over several days. An intravenous pyelogram revealed a normal outline of the urinary tract, and on cystoscopy a marked chronic bilharzial cystitis was found. Both ureteric orifices were normal and the efflux clear. Renal biopsy revealed some interstitial fibrosis with a very scanty round cell infiltration. The glomerular capsules showed some fibrous thickening and there was also a minor degree of arteriolar

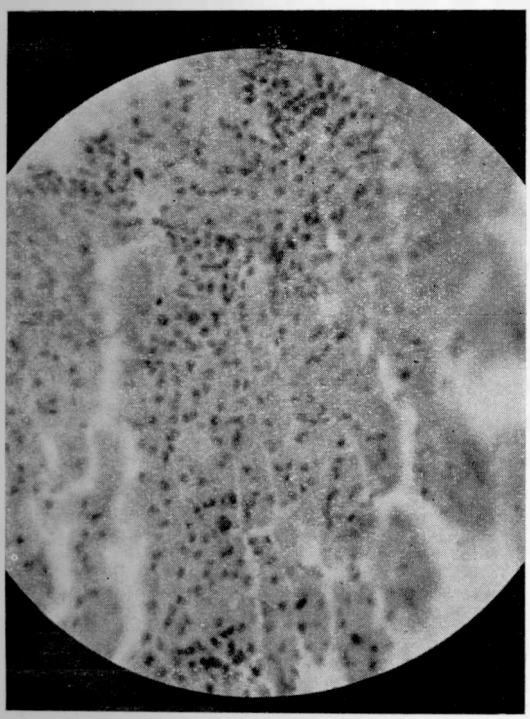

Fig. 8—Renal biopsy. Round cell infiltration (most of nuclei shown belong to the tubular epithelium, but many round cells present).

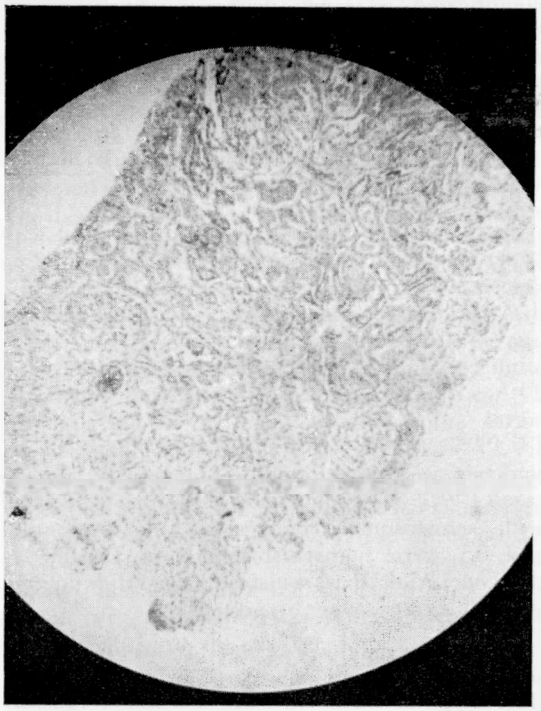

Fig. 9—Renal biopsy. Interstitial fibrosis of mild extent.

sclerosis consistent with a chronic interstitial nephritis. In three out of four other subjects in another series with calcified bladder and normal pyelogram the blood pressures were elevated:

(1) 175/140.
(2) 150/95 (bladder capacity of 250 ml.).
(3) 160/75 (bladder capacity of 350 ml.).

It might be asked if the bladder capacity is related to the degree of hypertension. We studied the blood pressure and bladder capacity in a series of 13 patients, irrespective of the condition in their ureters. A bladder capacity of 500 ml. was regarded as normal and definitely reduced when it was below 350 ml. (See Table II.)

Of the 13 patients, seven had a bladder capacity of 350 and under. Four of them had normal blood pressure and in three it was raised. Thus a small bladder is not necessarily associated with hypertension. I should mention that in this series no case of reflux was reported in the cystograms performed.

As a result of this preliminary work in which we are engaged at present, although not proven, there seems to be some evidence that schistosomal involvement of the urinary tract may be

complicated by some degree of hypertension, usually mild to moderate in extent. It is possible that in patients with a predisposition to hypertension this develops if the urinary tract is seriously affected by schistosomiasis.

PATIENTS ADMITTED BECAUSE OF HYPERTENSION

In the second group all patients admitted with hypertension to my wards were investigated to determine the number with schistosomal ureteric disease. Only patients with a diastolic pressure above 110 were included. Thirty-four were admitted from January, 1962, to June, 1963, and 29 were investigated. If the urine, stool and rectal snips showed negative results and the I.V.P. was clear, it was decided that schistosomiasis was not present. Fourteen of the 29 cases (49.7 per cent.) showed lesions consistent with schistosomal changes on the pyelogram and 15 were non-schistosomal, so I came to the conclusion that schistosomiasis did not appear to cause severe hypertension.

On further analysis of the 14 cases with both schistosomiasis and hypertension, we noted that their ages were 20, 15, 35, 38, 64, 22, 35, 30, 22, 40, 50, 33, 24 and 22, the average being 32 years. Of the 15 patients with hypertension and no schistosomiasis the ages were 35, 55, 62, 24, 14, 42, 42, 32, 45, 40, 45, 45, 54, 56 and 60, the mean being 45. Thus on the whole those without schistosomiasis seemed to be in an older age group than those with the disease. It may be that schistosomal disease in the bladder tends to bring out hypertension in a person predisposed to it or this may be an incidental finding. In this connection it might be of interest that in an earlier publication in 1962 I mentioned that I had noticed that many African patients with elevated pressures were under 10 years of age and suggested that urinary schistosomiasis might be a factor. Of the 19 cases I recorded then, only three were over 50 years of age, 11 were under 30 and five between the ages of 30 and 40.

ILLUSTRATIVE CASES

(1) A renal biopsy performed on one of the schistosomal patients aged 20 showed the typical features of chronic glomerulonephritis. The bladder was calcified and the blood pressure was 200/150. There were soft exudates in the retina, but at autopsy the cause of death was

Table II

SHOWING RELATIONSHIP BETWEEN BLADDER CAPACITY AND BLOOD PRESSURE

Case	Blood Pressure	Bladder Capacity, ml.	Ureters and Renal Pelves
1	125/90 (normal)	200	Dilatation of calyces.
2	100/70	250 (bladder calcified) (Chronic pyelonephritis as determined by renal biopsy)	Normal.
3	140/80	350	Renal biopsy normal.
4	120/80	500	Renal biopsy normal.
5	120/80	350	Hydronephrosis; renal biopsy normal.
6	145/90	350	Dilated ureter.
7	190/140	450	Ureteric disease; renal biopsy shows pyelonephritis.
8	165/95	400	Hydronephrosis, dilated ureter.
9	150/95	250	Kidneys normal; ureteric disease.
10	160/95	650	Hydronephrosis.
11	160/75	350	Kidneys normal.
12	170/100	550	Hydronephrosis; renal biopsy shows pyelonephritis.
13	140/110	400	Dilated ureters.

given as uraemia secondary to chronic pyelonephritis. Albumin +, granular casts, leucocytes and red blood cells + were present in the urine.

(2) In a patient aged 38 the renal biopsy showed arteriolar nephrosclerosis. His bladder was calcified with a slight dilatation at the lower end of the left ureter. The blood pressure was 170/100 and blood urea 22. The bladder capacity was 300 ml. The left ureteric orifice was of the golf hole type and the right one flattened and scarred. No. 4 catheter entered both, but was held up at 1 cm. each side. He had severe bilharzial cystitis with probable ureteric stenosis. The renal biopsy was reported on as arteriolar nephrosclerosis.

URINARY BILHARZIASIS AND THE NEPHROTIC SYNDROME

I have suggested (1963) a possible relationship between the nephrotic syndrome and urinary schistosomiasis. Again this is difficult to prove in an endemic region where, by the laws of chance, both conditions are likely to be found together sooner or later. There is no proof that the nephrotic syndrome is more common in schistomal regions than in non-schistosomal ones. Such a study has not been undertaken. But in a series of 15 cases I noticed that eight (53 per cent.) had complicated urinary schistosomiasis—a much higher figure than is found in the general population. These included calcification of the bladder, hydronephrosis and dilatation of the ureter. Therefore there is some suggestive evidence for the relationship. It is possible that urinary schistosomiasis may predispose to the nephrotic syndrome when complicated by hydronephrosis or where there is obstruction to the flow of urine in one or both sides of the urinary system. Possibly the toxaemia present in schistosomiasis may be a factor in its production (Fig. 10) (Gelfand, 1963).

CASE ILLUSTRATION

Here I am quoting a case I have just treated. Wilson was an African male, aged 22 years, who came to me because of oedema of the face, swelling of the abdomen and legs. He was passing a great deal of protein in his urine (Esbach about 6 G per day), which microscopically showed leucocytes, red cells and granular casts. His blood pressure was 150/100 and blood urea 29 mg. per cent. His total serum proteins was 4.7 G per cent., the S. albumin 1.7 G per cent., S. globulin 3.0 G per cent. and his serum cholesterol 620 mg. per cent. Ova of hookworm were present in his stool. Because of the red cells in his urine, I suspected schistosomiasis as well. A rectal snip was negative. A pylogram showed poor renal function on each side, but the lower third of the left ureter was slightly but definitely dilated. A cystoscopy was performed by Mr. Gordon, F.R.C.S. (Ed.) The bladder capacity was 300 ml. (lower limits of normal being 350). Diffuse schistosomal lesions affected the mucosa. A cast of fibrin passed through the right ureteric orifice. The right ureter was catheterised with difficulty. Only the tip of the catheter entered the left side. A renal biopsy was performed and the findings were suggestive of a chronic pyelonephritis.

RESISTANT RICKETS (OSTEODYSTROPHY)

When the kidney is damaged from obstruction lower down in the renal tract and pyelonephritis is present, another possibility is the development of a calcium losing condition in which the calcium leaks through the tubercles and a resistant form of renal rickets and osteomalacia ensues. I think this is very rare, but I have

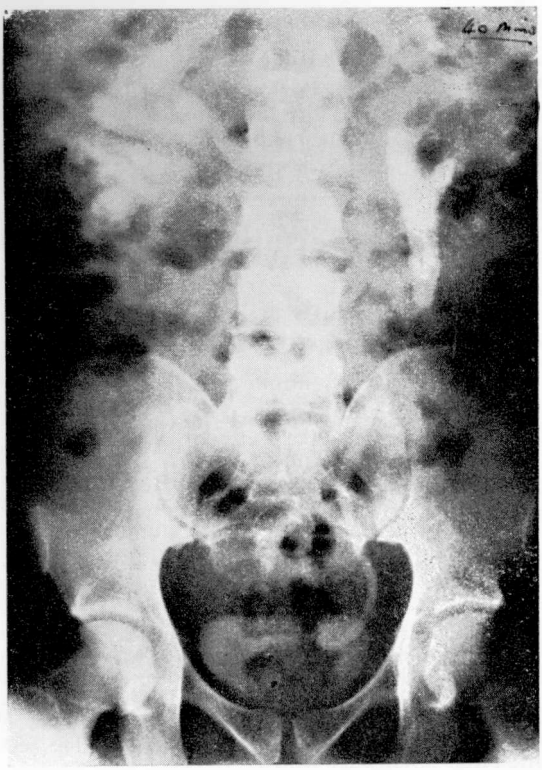

Fig. 10—Nephrotic syndrome in a patient with gross urinary schistosomiasis.

reported two cases and know of a third. I have not yet had confirmation of this form elsewhere (Gelfand, 1962).

SUMMARY

The relationship between chronic urinary schistosomiasis and hypertension is discussed as well as that with the nephrotic syndrome and renal osteodystrophy. There is some evidence, based on renal biopsy material, that a mild to moderate degree of hypertension occurs, possibly through an ascending pyelonephritis, when the disease is complicated by hydronephrosis or serious involvement of the ureter or bladder. Chronic pyelonephritis with pyelectasia may well be an important later complication of schistosomiasis. It is also possible that in a person predisposed to hypertension the additional burden of serious disease in the lower urinary tract is liable to induce the hypertension earlier.

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