

The Urological Aspects of Bilharziasis in Rhodesia

BY

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PART V

FURTHER INVESTIGATIONS

The next step is to elucidate the damage resulting from ovideposition and fibrosis by carrying out as indicated the standard urological investigations of straight X-ray, intravenous pyelography, retrograde pyelography, cystometry and cystography.

CALCIFICATION OF BLADDER AND URETERS

In the plain film, calcium deposits may be seen in the bladder and ureters in heavy infestations. Their extent varies from faint lines to heavy massive deposits in the bladder and both ureters. As heavy infestations are seen mainly in Africans, so calcification occurs mainly in them. In many hundreds of X-rays taken of Europeans who have had bilharziasis, calcification in the bladder was encountered in only two men (ages 28 and 47).

Bladder calcification is common in the African and we have found it in 17 per cent. of them and in 59 per cent. of our present series referred specially because of advanced bilharzial disease. The age incidence shows how quickly calcification takes place, although the highest frequency was in the 21-30 age group (Table IV).

Table IV

SHOWING PERCENTAGE, ACCORDING TO AGE GROUP, OF CALCIFICATION OF BLADDER DEMONSTRATED RADIOLOGICALLY

Age Group	(Total No. of Cases, 59)
10-20	18 cases (30 per cent.)
21-30	28 cases (48 per cent.)
31-40	13 cases (22 per cent.)

Contrary to what is sometimes said (Sayegh, 1950, 1956), our series demonstrated that calcification in the bladder wall is not necessarily associated with an inelastic wall and not all

bladders of reduced capacity due to fibrosis following schistosomiasis are calcified. However, it is true, as shown in Table V, that a high proportion of bilharzial bladders of small capacity show calcification (Figs. 1, 2, 11, 12).

Table V

BLADDER CAPACITY COMPARED WHEN ORGAN IS CALCIFIED AND NON-CALCIFIED (AFRICANS ONLY SUFFERING FROM ADVANCED BILHARZIASIS)

	Calcified	Non-calcified
Average capacity	395 ml.	435 ml.
Highest capacity	650 ml.	650 ml.
Lowest capacity	70 ml.	280 ml.
Capacity under 300 ml.	29 per cent.	7 per cent.
Capacity of 350 ml. and less	33 per cent.	24 per cent.

In our series the average capacity of bladders showing calcification was 395 ml., the lowest being 70 ml. and the highest 650 ml. Many with gross calcification had capacities of 500 ml. and over, whereas many with minimal calcification had capacities below 300 ml. The capacity of a healthy bladder varies from 450 to 500 ml.

Ten per cent. of Africans examined for fibrotic complications showed calcification in the ureteric wall, but this was not seen in the absence of similar calcification in the bladder wall.

INTRAVENOUS PYELOGRAPHY

Films taken after the intravenous injection of contrast medium usually demonstrate whether pathological changes have occurred in the ureters. The earliest sign of ureteric disease is a persistent filling of the lower segment of the ureter in all films of the series (Fig. 13). Although this is seen occasionally in non-bilharzial patients, in bilharziasis this sign is frequent. In our series it was seen in 20 per cent. of Europeans and in 18 per cent. of a series of Africans whose ureters were not grossly dilated. The segment of ureter which does not empty is usually somewhat dilated, though not invariably so (Campbell-Begg, 1946).

Dilatation of the ureter is a more advanced stage than persistent filling. The lower third of the ureter is usually the portion which is dilated. The dilatation may be either slight or gross and it may occur either in the absence of stenosis (Figs. 8, 9, 14) or in conjunction with it (Fig. 15). The presence of stenosis cannot usually be established without a retrograde pyelogram. The distortion seen on intravenous pyelography



Fig. 11—African aged 16. Bladder with a thin line of calcification and a capacity of only 220 ml.

may suggest the presence of a stricture, while the retrograde procedure shows this to be incorrect.

The dilatation not infrequently affects the whole ureter with or without the pelvis and calices. Extensive dilatation is usually associated with either ureteric stenosis (Fig. 16) or a fibrosed bladder of small capacity (Fig. 17) or obstruction of the bladder neck. In 7 per cent. of our African subjects, however, dilatation of the whole ureter and hydronephrosis occurred without any of the above three causes being present, the sole lesion being an extensive involvement of the ureteric wall, which must have affected its muscle power and tone (Gelfand, 1948; Gelfand and Honey, 1953). The hydronephrosis is of the same nature as is found above ureters involved in non-specific

ureteritis. It is interesting to read that Ove Noring (1958) remarks that the cause of the hydronephrosis is not quite obvious and also assumes it to be due to dynamic factors.

Dilatation is usually irregular, giving the ureter a beaded appearance and may affect one or both sides (Figs. 18 and 19). On account of these various obstructive uropathies, renal function, and therefore concentration of opaque media, is often poor.

When stenosis occurs along the length of the ureter dilatation is almost invariably as great below the stenosis as it is above it, showing that the dilatation is as much a primary effect of the fibrosis as is the stenosis (Fig. 20).

In the small distorted bladder, in which the ureteric orifices are displaced backwards, the

resulting high insertion of the ureters with excessive curvature in the justa-vesical portion can sometimes be observed on intravenous pyelogram (Fig. 21).

Those patients who show abnormalities on the intravenous pyelogram require a retrograde study to establish the exact pathology. As a preliminary measure or while performing a cystoscopy, a cystometric reading is taken to determine the bladder capacity and pressure curve.

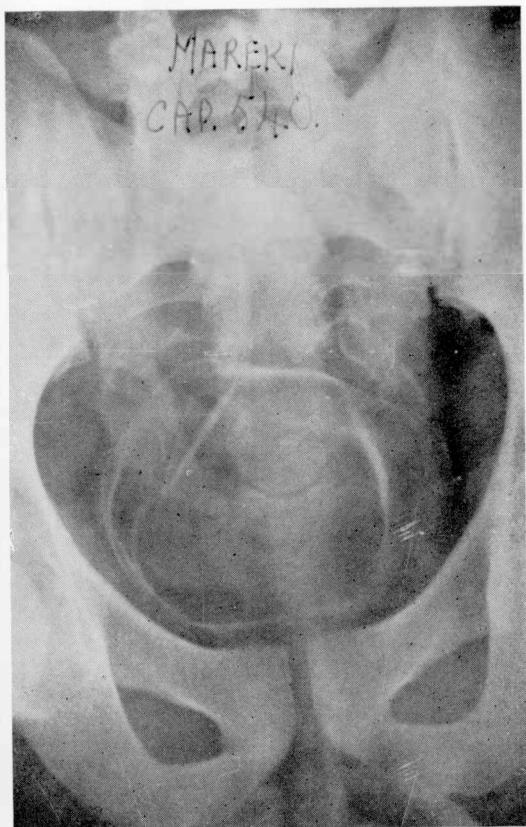


Fig. 12—African aged 23. Bladder with more marked calcification than that in Fig. 11, and capacity of 540 ml.

Immediate, delayed and micturating cystograms were also done to determine the presence of ureteric reflux. Reflux of the medium up the ureter was not found in Europeans, but it occurred in 11 per cent. of the Africans. In eight it was marked, all of whom had reduced bladder capacities varying from 60 to 300 ml. In one, reflux was slight; his capacity was 450 ml.

After inspecting the posterior urethra and bladder neck with a panendoscope, the bladder wall and ureteric orifices are inspected. An intravenous injection of indigo-carmine is then given and the efflux watched. If the renal function is sufficiently good to concentrate the dye, the type of efflux can be of help in diagnosis. With a stenosis of the ureter near the entrance into the bladder the dye can be seen emerging in a jet of fine bore, which at times is extremely fine. Should the ureter be grossly dilated the dye, instead of entering the bladder in jets of good force, trickles out in a constant stream. Although we have made no more detailed studies of ureteric peristalsis in these cases, this constant trickling stream is sufficient evidence of a lack of contraction or impaired peristalsis in at least the lower third of the ureter.

The size of the ureteric orifice and lumen of the ureter above is then investigated by passing bougies and catheters along its length. A normal orifice and ureter should admit an instrument of size at least 9 Charrier with moderate ease, and any difficulty in the passage of this size or smaller is recorded as a possible narrowing.

The majority of stenoses which we have investigated lie at the level of the vesical submucosa. The next most frequent position is the intravesical one up to 1.5 cm. (Fig. 22). These two sites accounted for 87 per cent. of strictures met with in our European patients and 88 per cent. in our Africans.

A lesser number lie in the extravesical portion of the ureter, within 2.5 cm. of the orifice (Fig. 23). Three per cent. of strictures in both African and European series were found in this situation, but in only 1.3 per cent. of Europeans and 3 per cent. of Africans was the stricture found opposite the third or fourth lumbar vertebra (Fig. 24). These were all present on the right side in the Europeans and on the left side in Africans. This small series does not therefore bear out Makar's contention (1948) that anastomosis between the systemic (ureteric) and portal veins at this site is much greater on the left than on the right.

The size of the orifice is usually obvious when viewed through the cystoscope, but confirmation by watching the efflux of indigo-carmine and by instrumentation must be obtained before carrying out any therapeutic measure. An orifice which does not look stenosed and which emits a stream of good bore can scarcely be stenosed, but frequently difficulty is experienced

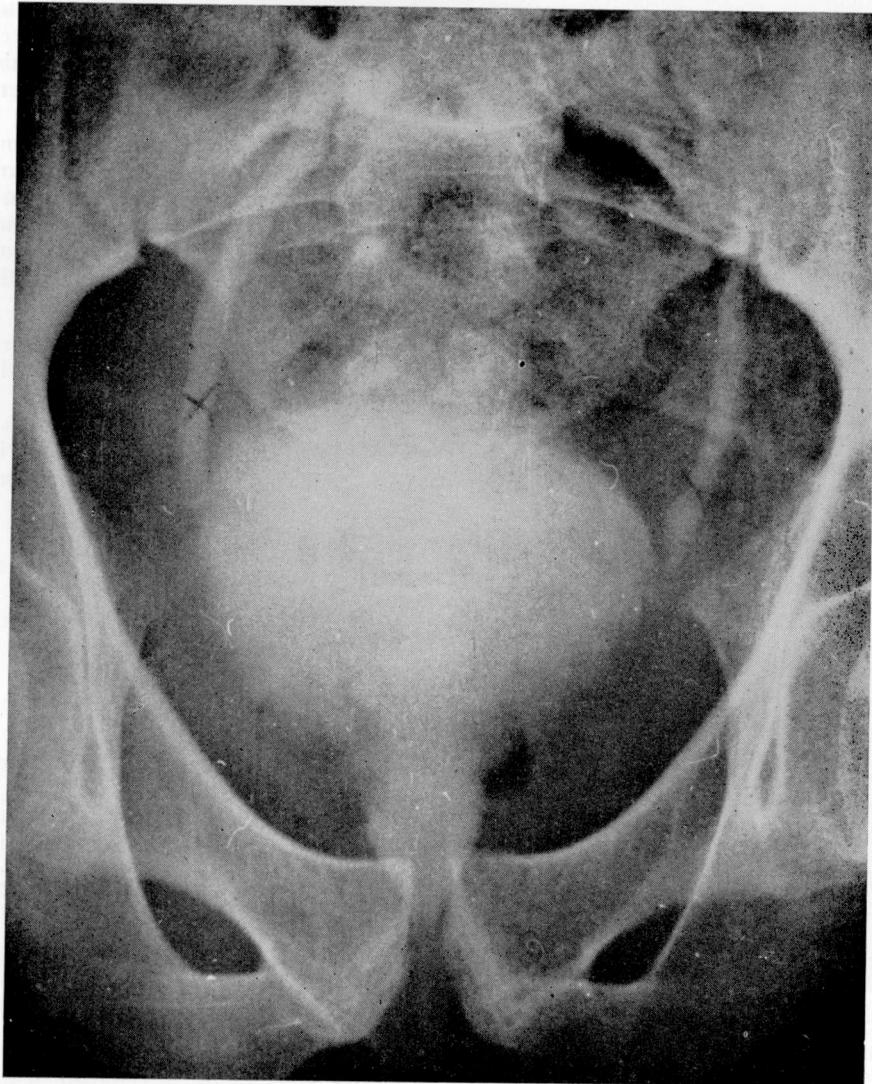


Fig. 13—African aged 28. Delayed emptying both ureters. No evidence of stenosis of the intravesical ureter. Bladder capacity, 550 ml.

when introducing instruments into it. This difficulty is due to the hard, unyielding nature of the bladder wall and the unusual orientation of the orifice, which does not readily allow the catheter tip to be engaged. If the orifice appears narrowed, emits a fine stream of indigo-carmine and fine bougies and catheters beyond size 3 Charrier cannot be admitted, a stenosis requiring treatment is present.

If no bougie or catheter can be made to enter the orifice, a cystoscopic meatotomy is carried out and the patient asked to report back in five to six weeks for re-assessment before the ureter and kidney can be investigated by retrograde examination. A McCarthy panendoscope with a rigid diathermy knife is used and an incision made along the ureteric ridge for a distance of approximately one centimetre above the ureteric orifice; or alternatively a transverse incision across the ridge one centimetre above the orifice is made. This procedure was carried out on 68 occasions in Europeans and 36 in Africans. It will be seen at the end of five weeks in most

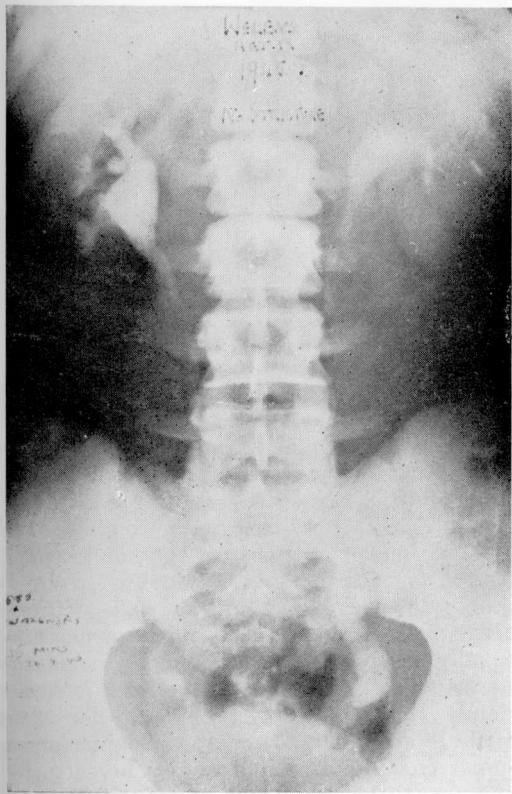


Fig. 14—European aged 12. Intravenous pyelogram showing dilatation and distortion of the lower third of the left ureter. No stricture. No. 10 F bougies passed this point with ease.

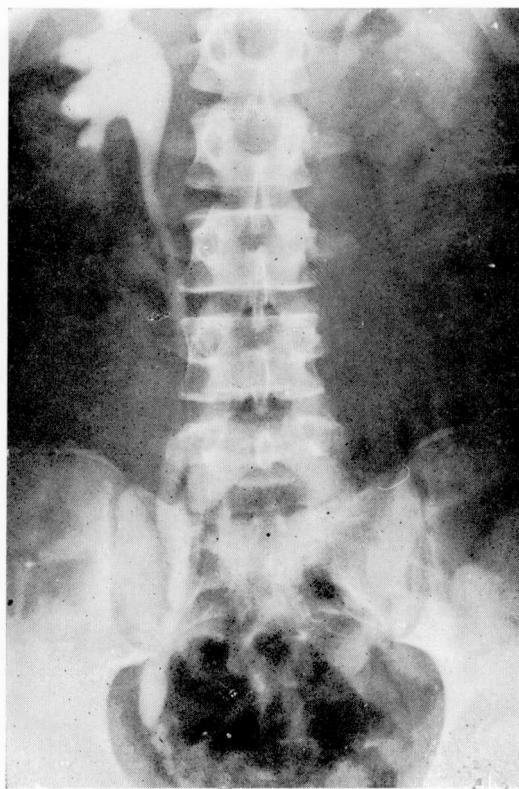


Fig. 15—European aged 15. Intravenous pyelogram. Stricture of right ureter 5 cm. proximal to bladder, with dilatation of ureter and hydro-nephrosis. Treated by excision of 5 cm. ureter and neocystostomy.

cases that the stenosis has been confined to the submucosa of the bladder in the region of the ureteric orifice and that the lumen above this point is patent. Occasionally, however, the narrowing extends through the area incised and above it, and on the second examination the exposed ureter is still stenosed. A second and higher incision through the muscle of the bladder wall is necessary. This was necessary five times in Europeans and once in an African. We have only once failed with two incisions to expose a ureteric lumen large enough to admit a catheter or canalised bougie sufficiently to allow of the injection of a contrast medium in order to obtain a uretero-pyelogram.

On investigating the ureter above the bladder wall we pass Nos. 8 and 9 Charrier bougies either through the normal ureteric orifice or the orifice already treated by cystoscopic meatotomy. If the bougie passes easily for 25 cm., it is obvious that no stenosis exists. Should, however, the bougies and catheters be held up,

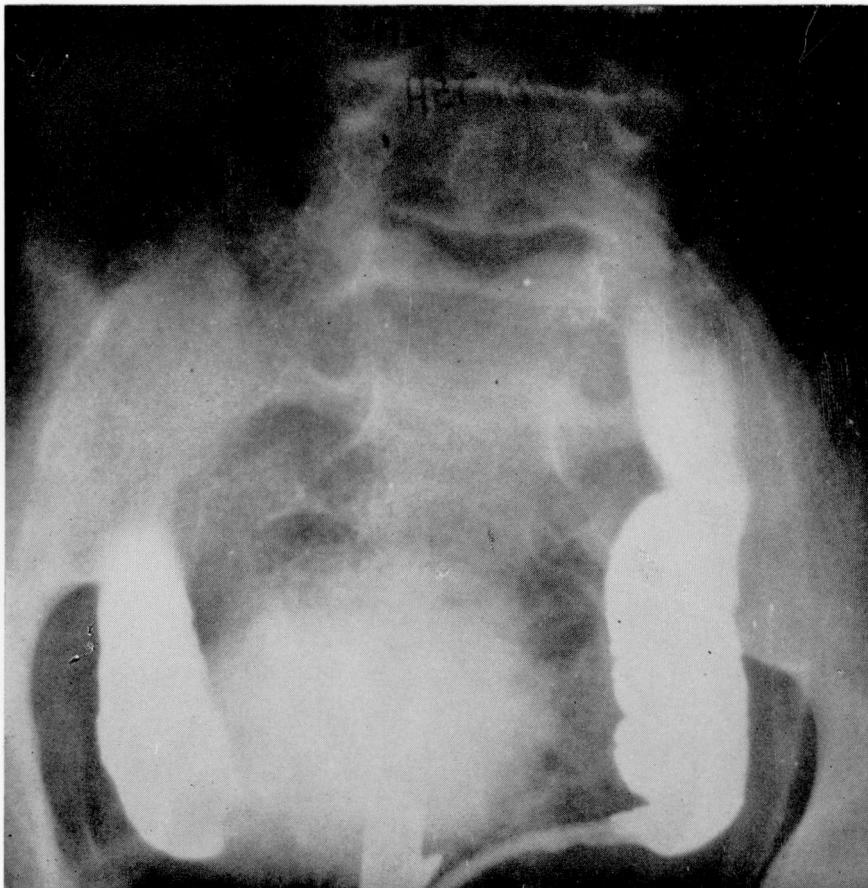


Fig. 16—African aged 15. Gross dilatation of both ureters above intramural strictures.

the cause of the obstruction must be determined. It is occasionally due to spasm, which can be relieved by a spinal anaesthetic, when bougies pass with ease, or it may be due to irregularities and pockets in the lumen of the ureter amongst masses of bilharzial granulation tissue. In this case, when the intravenous pyelogram suggests ureteric or renal pathology, or does not exclude it, a retrograde ureteropyelogram under a spinal anaesthetic is carried out. The ureteric orifice is blocked with either a Braasch bulb whistle tip catheter or with the olivary head of a Ravitch irrigating bougie and 8 ml. of medium injected. An excellent picture of the whole ureter, pelvis and calices is thus obtained. Occasionally the orifice will not admit the tips of these olives and, with the obstruction lying 0.5 to 1.0 cm. from the orifice, dye fails to ascend when injected through an ordinary ureteric catheter with lateral eyes. We have obtained

satisfactory pictures in all these cases except one by passing a No. 4 Ch. catheter with only a terminal eye, which is held firmly against the obstruction during the injection of the medium (Fig. 23). The resulting uretero-pyelograms demonstrate clearly the outline of the ureteric lumen and whether any obstruction to the passage of bougies is due to stenosis or simply to irregularity in the wall. Strictures of the intramural segment can be demonstrated equally well by this technique. It should never be assumed that a bilharzial ureter is stenosed simply because no bougie or catheter can be made to enter it. A uretero-pyelogram under a spinal anaesthesia should always be carried out and the pathology demonstrated clearly before therapy is advised.

Uretero-pyelograms frequently demonstrate marked dilatation above an intravesical stricture. The dilatation may affect only the lower third,



Fig. 19—European aged 20. Showing beaded appearance of ureter.

Numerous combinations of ureteric disease are found. Of the 94 European patients investigated with strictures in 121 ureters, 32 had them on the right, 35 on the left and 27 on both sides. Among the 100 Africans, 42 had them in 55 ureters. Of these, 17 were on the right side, 12 on the left and 13 had bilateral strictures. Seventeen (6 per cent.) of the Europeans

Table VII
SIDE OF STRICTURE IN 42 AFRICAN SUBJECTS

Number of ureters involved	55
On right side	17
On left side	12
On both sides	13

Table VIII
FREQUENCY OF STRICTURE IN EUROPEAN AND
AFRICAN SERIES INVESTIGATED

No. of Subjects	Number with Stricture	Percentage
European: 300	94	31
African: 100	42	42

and 10 (10 per cent.) of the Africans had strictures on one side and dilatation of the ureter without stricture on the other.

HYDRONEPHROSIS

Hydronephrosis was seen in 42 European patients involving 53 kidneys. It was always relatively mild in degree and in every case it was associated with a stricture at some point in the ureter. On intravenous or retrograde pyelography the urinary tract was seen to be dilated from the point of the stricture up to and including the calices. In the African, hydronephrosis was seen in 58 cases (58 per cent.) affecting 100 kidneys. In 26 it was asso-

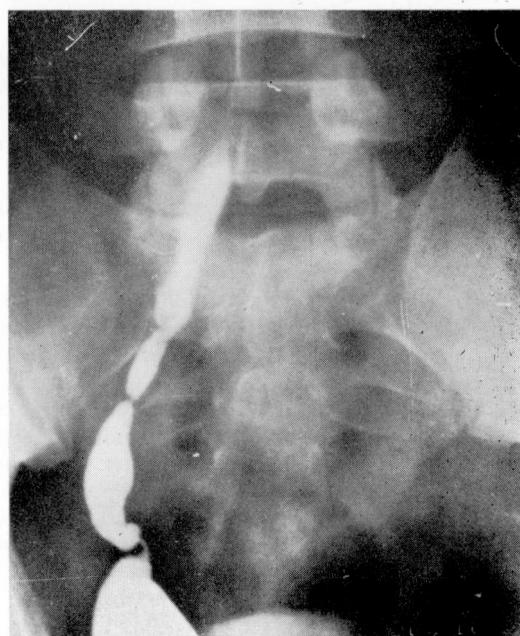


Fig. 20—European aged 26. Illustrating dilatation of ureter above and below the stricture.

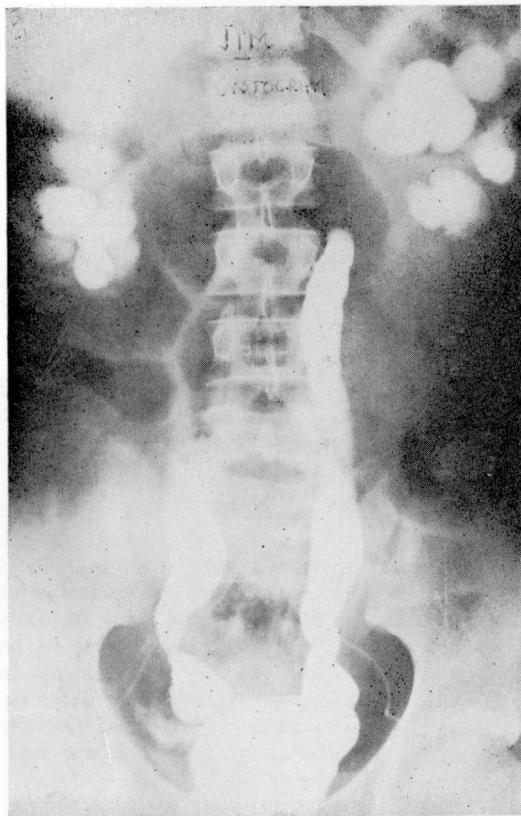


Fig. 17—African aged 18. Cystogram showing bilateral dilatation of ureters and hydronephrosis due to fibrosed bladder of small capacity. Total capacity, 120 ml. Treated by ileocystoplasty.

but above the more marked stenoses, the whole ureter and also the pelves and calices are dilated (Fig. 10).

The ureterogram often demonstrates ureteric dilatation in the absence of stenosis. The dilatation may involve only the distal third of the ureter and appears to be due to weakening of this part of the wall by fibrotic replacement of muscle. Dilatation of the whole ureter is also met in Africans in whom no stricture could be demonstrated and whose bladders were of normal capacity. The ureters were extensively diseased throughout their whole length and had lost the power of muscular contraction. This was seen in 7 per cent. of our advanced series.

Extensive dilatations which involve the whole length of the ureter, the pelves and calices are also seen in the absence of stenosis and associated with bladders of reduced capacity and increased

intravesical pressure. This type of lesion was seen in 22 per cent. of Africans examined.

Those with stenosis outside the bladder wall show dilatation above and below the narrowing to a more or less equal extent, suggesting that the stenosis is an incidental occurrence in an otherwise chronically dilated fibrotic ureter. Above the stenosis there is frequently hydro-nephrosis, usually mild in Europeans, but often extensive in Africans (Fig. 25).

Table VI
SIDE OF STRICTURE IN 94 EUROPEAN SUBJECTS

Number of ureters involved	.....	.....	121
On right side	.....	.....	32
On left side	.....	.....	35
On both sides	.....	.....	27



Fig. 18—European aged 26. Beaded appearance of ureter due to multiple lesions.

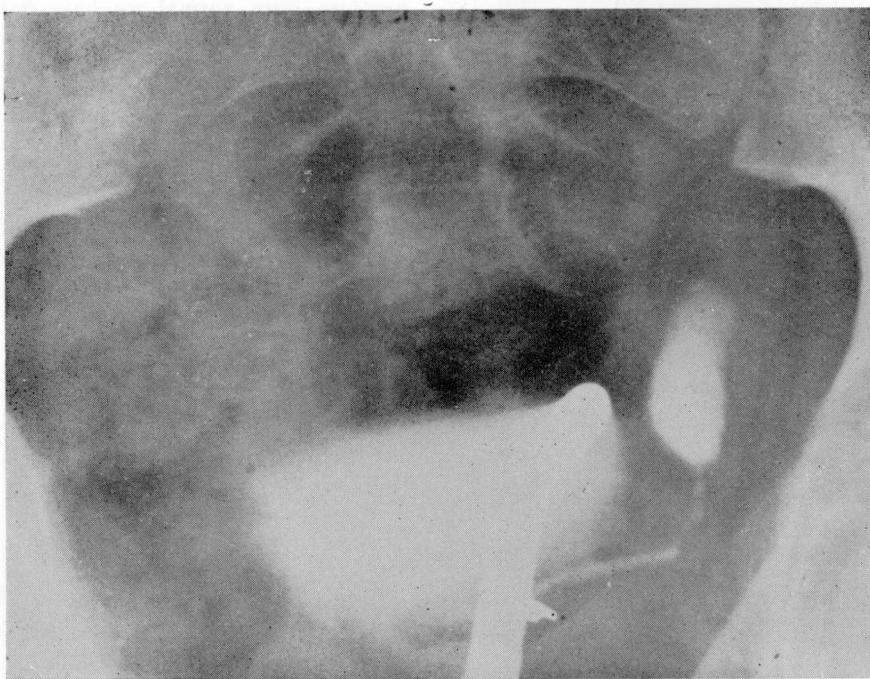


Fig. 23—European aged 14. Stricture of ureter extending 1 cm. proximal to bladder wall. Treated by excision and neocystostomy.

ciated with strictures and affected 40 kidneys. In some the degree of hydronephrosis was slight, whereas in others it was gross.

Hydronephrosis was associated with a bladder of reduced capacity and high intravesical pressure in 20 African patients (20 per cent.) involving 40 kidneys. The average capacity of the bladders was 210 ml., the lowest being 60 ml. and the greatest 350 ml. The hydronephrosis varied from slight clubbing of the calices to gross dilatation of the calices and pelvis. Vesico-ureteric reflux was demonstrated in 14 of the subjects; in all, the ureteric orifices were retracted and distorted.

Some African patients with fibrotic inexpandile bladders of lesser degree who complain of marked frequency of micturition escape renal damage, while others with somewhat greater capacities develop hydronephrosis. Ten Africans who had capacities varying between 210 ml.

and 380 ml. were studied. Their average capacity was 310 ml. Each complained of increased frequency by day and night, but none showed evidence of hydronephrosis. In none of them was vesico-ureteric reflux seen, although, as in the previous group, all ureteric orifices were retracted and distorted.

Table IX
INCIDENCE OF HYDRONEPHROSIS IN THE
TWO RACES.

1. In European series 42 cases out of 300=14% (always associated with stricture)
2. In African series 58 cases out of 100=58%

The ureteric orifices of all these 30 cases just described were distorted and retracted, but in only 14 was reflux demonstrated, and the capacities in them were very low and the pressure high. As vesico-ureteric reflux occurred in only



Fig. 24—African aged 28. Retrograde pyelogram showing gross hydronephrosis above a stricture at the level of lumbar vertebra IV.

14 of the 30, the reflux by itself cannot be said to be the cause of the hydronephroses which was a feature of all 30, nor was there any sign of ureteric stenosis to account for the hydronephroses. We therefore consider that hydronephrosis was due to the increased intravesical

pressure. If reflux occurred it was due to a combination of increased pressure and distortion of the orifice (Makar, 1948; Hutch, 1958).

In many patients whose bladder capacity and pressure were normal we have induced vesicoureteric reflux by damaging the uretero-vesical valve, both by extensive meatotomy and by excision and neocystostomy. In every one of these patients we have demonstrated during micturition reflux which causes considerable dilatation of pelves and calices as micturition proceeds. The kidney, however, functions normally between the acts of micturition (Fig. 26, A and B).

We have observed 14 such patients over periods varying from two to 14 years, the average being five years. In all of them the hydro-nephrosis which was previously present above the stricture which had been incised or excised has disappeared, despite the fact that vesicoureteric reflux exists.

As we find it impossible to treat some strictures of these grossly diseased ureters without pro-



Fig. 25—African aged 24. Bilateral strictures lower third of ureters showing dilatation above and below the strictures, and hydronephrosis. Bladder capacity, 500 ml.

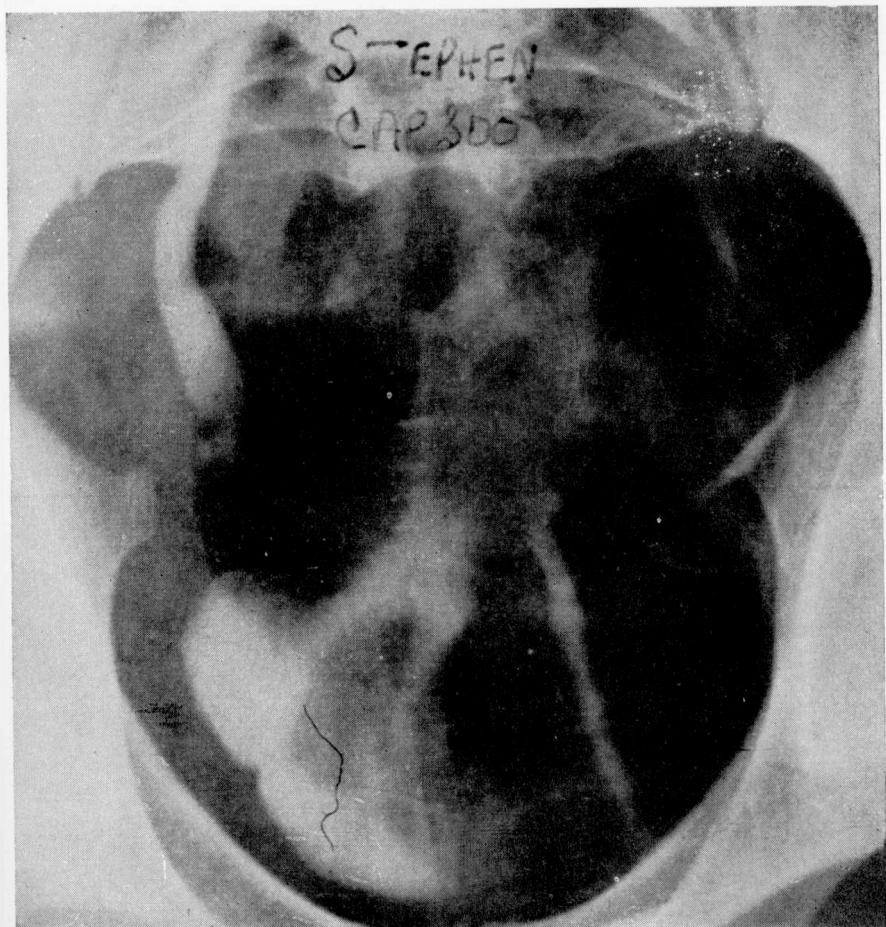


Fig. 21—African aged 26. Intravenous pyelogram showing high insertion of ureters.

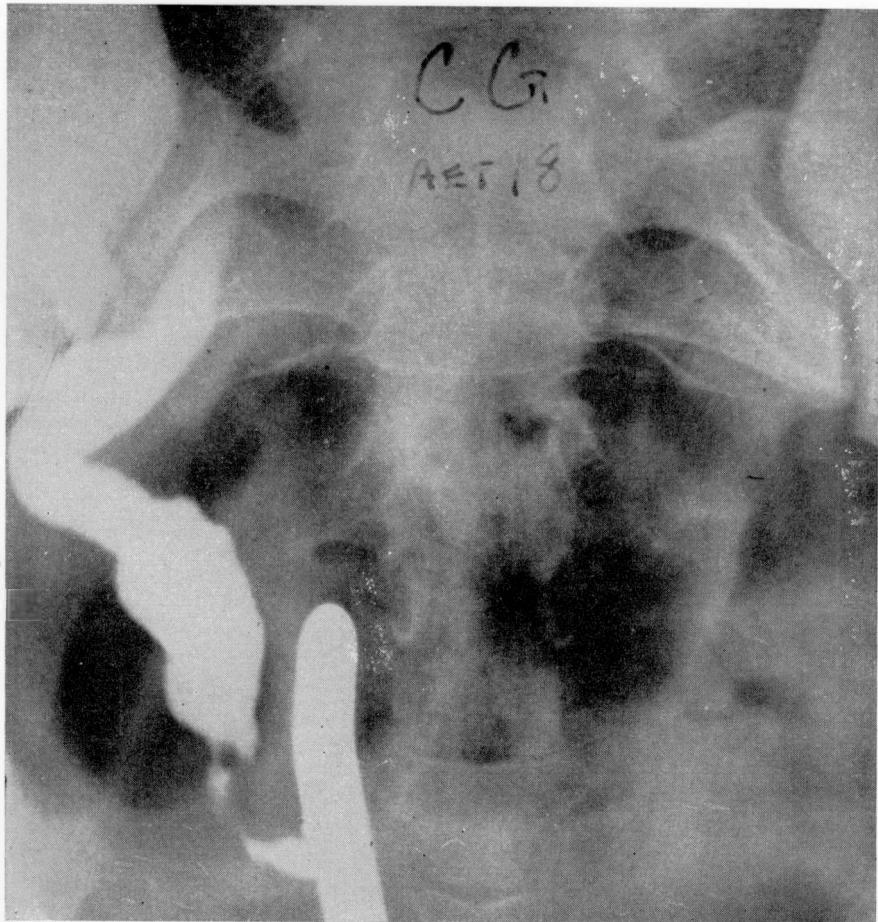


Fig. 22—European aged 18. Showing stenosis of intramural portion of ureter.

Fig. 26--European aged 36. Cystograms taken one year after excision of strictured ureter and neocystostomy.



- A. Delayed cystogram, showing reflux up ureter into pelvis and calices, but no dilatation.



- B. Micturating cystogram taken 15 minutes after A, showing dilatation of pelvis and calices associated with the increased intravesical pressure.

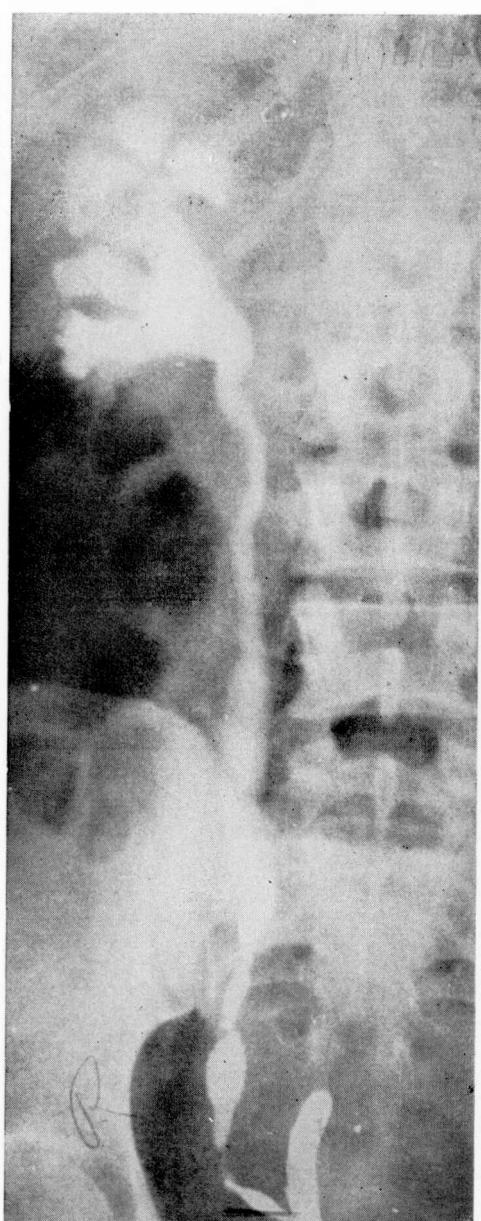


Fig. 27—European aged 40. Retrograde pyelogram showing stenosed, distorted ureter and hydronephrosis in advanced tuberculosis.

ducing vesico-ureteric reflux, it becomes necessary to observe whether reflux in itself is serious. In our small series reflux, in the absence of increased intravesical pressure or infection, seems to be compatible with good health (Orr, 1950).

Seven African patients whose bladder capacities were normal and in whom no stricture could be demonstrated had hydronephrosis which appeared to be due to fibrotic, distorted and functionless ureters. In none was vesico-ureteric reflux a feature.

Table X
CAUSE OF HYDRONEPHROSIS IN THE 58
AFRICAN CASES

Bladder of reduced capacity and high intravesical pressure	26 cases
Stricture of ureter	25 cases
Without stricture or small bladder	7 cases

Calculi

Among Europeans, calculi were not found more often in those suffering from bilharziasis than in those free of the disease. In our series of 300 Europeans we found ureteric calculi in only two patients, and in 100 Africans ureteric calculi were found in three patients.

Differential Diagnosis of Ureteric Stenosis

In the Federation, where bilharziasis is so common but renal tuberculosis relatively infrequent, it should not be assumed that every ureteric stricture or distortion is due to bilharziasis. The pathology of the two conditions is not dissimilar, with bladder contraction, ureteric dilatation and stenosis and hydronephrosis common to both. The ureterogram in tuberculosis can very closely simulate that seen in bilharziasis (Fig. 27). A careful search for *Myco. tuberculosis* in the urine, including animal inoculation, should therefore be made in every case before assuming ureteric stenosis to be bilharzial in origin. Special care should be taken if no bilharzial lesion can be seen in the bladder on cystoscopic examination.

(To be continued)