

EPIDEMIOLOGY AND UROLOGICAL COMPLICATIONS

OF

SCHISTOSOMIASIS HAEMATOBIIUM

A THESIS SUBMITTED FOR THE
DEGREE OF DOCTOR OF MEDICINE
IN THE UNIVERSITY OF NAIROBI

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To
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and to

Eliza, Helen, Carol , Francis & Marjorie

C O N T E N T S

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DECLARATION

I certify that this is my original work done according to the requirements and regulations of the university of Nairobi for the degree of M.D. All the help received are acknowledged.

It has not been submitted wholly or in parts to any other university.

H. B. OBONYO

A C K N O W L E D G E M E N T S

It is indeed very difficult to do any scientific work in an up-country hospital over 600 miles from the nearest Medical School. That I embarked on and completed this work, means I was assisted a great deal by people and institutions. I am indebted to Dr. A.Y. Mvungi, D.M.O. Shinyanga, Mr. H.S.A. Mbao, Medical Assistant i/c Tinde Health Centre and Mr. Amos Njuka, my Health Officer, for the organisation of the field survey. It needs more than good organisation to follow-up patients in the African villages. I must also mention how helpful the Chama Cha Mapinduzi (C.C.M.) officials were to me. The laboratory work was done by Mr. S. Mkwel^a and Miss Mary Shushu and preparation of the pictures by Mr. Godfred Sunguti. The maps were prepared by Mr. Denis Malunda.

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A B S T R A C T

The literature review covered the development of knowledge about Schistosomiasis from the discovery of the worm by Bilharz in Egypt, the discovery of the intermediate host by Miyairi and Suzuki in Japan to the recent epidemiological and clinical reports. After Bilharz, subsequent work in Egypt evolved around the epidemiology and control of the disease with some sporadic reports on the clinical aspects of bilharziasis. The severity of the disease caused concern right from the time of Lord Kitchener.

Although the presence of the disease was recorded in East Africa as early as 1911, its clinical importance was not appreciated. Earlier work was basically epidemiological aimed at establishing the prevalence of the disease. It was Forsyth and his co-workers who first revealed the gravity of the urological complications of bilharziasis in North-West Tanganyika and Zanzibar. The systematic documentation of surgical methods for the treatment of these conditions besides the work of Makar in Egypt and Honey in Rhodesia, was not attempted.

[This study was prompted by the knowledge, from clinical observations, that complications of schistosomiasis haematobium cause considerable morbidity and mortality in the Sukumaland. The objectives of the study were to establish the prevalence of the urological complications of bilharziasis, to test the various methods of investigation and to assess surgical treatment. A prevalence survey was thus conducted at Tinde, an area within the radius served by the hospitals in which the author worked. Mid-day urine samples were collected from the unselected population of five villages which form Tinde Ward. The formalin preserved specimen were examined for Schistosoma haematobium ova using 10 mls centrifuged deposit method. All together 3687 people were examined and 1921 were found positive, a prevalence of 52.1%. The maximum prevalence occurred at the age of 10 years and that same age group had the heaviest egg load.

A clinical study of the random sample of the positives from two villages at the opposite ends of Tinde was done to

assess the prevalence of the urological complications. The sample of 78 people were admitted and 75 were investigated. Three were eliminated because of pregnancy. The investigations included the clinical features, urinalysis, intravenous pyelography and cystoscopy.

Radiological abnormalities, ureteric lesions, bladder filling defects, bladder calcification and urinary calculi, were detected in 69.3%. The commonest findings were ureteric lesions, seen in 62.7%. Most of the ureteric lesions produced definite radiological defects but without proximal dilatation. They were regarded as early or minor lesions (grade I). The lesions which caused dilatation of the ureter and pelvis without alteration of the shape of the calyces (grade II) and those causing hydronephrotic changes (grade III) were regarded as severe lesions. Severe ureteric lesions therefore formed 25.3%. The younger children had more of grade I lesions while the older children had more severe lesions. It was also noticed that the lesions were more common in older children. Ureteric lesions were present in 43.7% of the children aged 2 - 10 years and 60% of the children aged 11 - 20 years.

Endoscopic facilities were available for the examination of all age groups. The earliest bladder mucosal lesions observed were discrete ova in the mucosa with no sign of inflammation around them. These changes were frequently associated with bullae and mucosal polyps with occasional intramucosal haemorrhages. They correspond to the early ureteric lesions. The children with back pressure changes were observed to have granulomatous and tuberculous lesions, established chronic inflammation. Late mucosal changes consisting of sandy patches, discrete tubercles and deformity of the ureteric orifices were common in adults. Bladder mucosal biopsy showed some live ova even in late lesions.

The incidence of double infection of *S. mansoni* and haematobium was low, 5.3%. Other investigations were not found helpful for assessing the extent of urinary tract damage in the early stages. More than half of the people had eosinophilia.

[The second part of the study is a review of the patients

with urological complications of schistosomiasis treated in Mwandui Hospital and followed up for more than three years. A total of 94 patients had operations for ureteric stenosis, urinary tract calculi, contracted bladder and carcinoma of the bladder.

The indications for operation in ureteric stenosis were worked out to be grade IV lesions (non-functioning kidney), grade III lesions and grade II lesions with severe symptoms or recurrent upper urinary tract infection. The operative procedures included simple ureteric meatoplasty, ureteroneocystostomy, bladder flap and ureteroileocystoplasty. Anti-reflux procedures were sacrificed in favour of wide stomata to avoid restenoses. The indications for each procedure are outlined.

The obstructive stenoses were efficiently corrected by these plastic procedures but the functional results were limited by the extent of structural changes that had occurred before operation. The gross hydronephrotic kidneys have not been seen to revert to normal. The best time to operate is immediately blunting of the calyces is noticed. Earlier operation is not advisable because many patients with dilated ureters show no sign of progressive deterioration.

No other aetiological factors were observed in association with the urinary tract calculi, many of which were "asymptomatic" but caused extensive destruction of the urinary tract. Early lithotomy for renal and ureteric calculi was found expedient. Even small ureteric calculi rarely pass down on conservative treatment because of stenosis of the segment of the ureter within the muscular layers of the bladder wall. Bladder calculi are usually large enough to require cystotomy and removal. The rate of post-operative infection following vesico-lithotomy was found to be high.

The common presenting symptoms of carcinoma of the bladder were haematuria, pyuria, hypogastric pain, dysuria and frequency. More than a third of the patients had palpable suprapubic masses on admission. The tumours were often large and sessile. Clinical staging and biopsy were done at cystoscopy. The majority, 71%,

were squamous cell carcinomas. Only two patients were suitable for electrosurgical procedures. The rest of the tumours infiltrating the bladder muscle were assessed for open operations. All tumours which were in stage T2 and T3 were offered partial cystectomy or total cystectomy if the former was contraindicated. The merits and disadvantages of both operations are discussed. Post-operative follow up tends to show that partial cystectomy is a better operation.

REVIEW OF THE LITERATURE

The discovery of a "white long helminth" in the blood of portal vein of a young Egyptian at autopsy by Theodor Bilharz in 1851 in Kasr-El-Ainy hospital, Cairo, marked the most important milestone in the evolution of scientific knowledge of schistosomiasis. He made a fairly accurate description of the trematode which he named *Distomum haematobium*. In subsequent studies, Bilharz (1853) indentified the typical pathological changes caused by distoma in the urinary and gastrointestinal tracts.

Although minor anatomical errors necessitated renaming of the parasite to *schistosoma haematobium* by Weinland and Gobbold in 1858 and the rules of modern nomenclature prevailed over subsequent change to *Bilharzia* suggested by Gobbold, the description of the disease process crystallised by Bilharz (1856) is yet to be excelled. He reported:-

- (i) The macroscopic and microscopic features of the fibrotic changes.
- (ii) The polypoid hypertrophy with soft well vascularised fungating projections of the mucous membrane containing mainly ova in the fresh state.
- (iii) Ulcer formation in the bladder.

He also commented on the association of the disease with urinary calculi. The relationship of these pathological changes with *Distomum haematobium* could not be accidental, he argued, as there were large numbers of ova in all the lesions and the amount and character of the ova were related to the intensity of the disease.

Bilharz recognized ova with terminal as well as lateral spines but failed to appreciate the duality of the trematodes producing them. He described the miracidia accurately but failed to trace their fate in water.

Evidence of the existence of the disease from prehistoric ages was produced by Ruffer (1910) when he discovered bilharzial ova in the kidneys of the twentieth dynasty Egyptian mummies. He had no access to specimens of the bladder or ureter.

Far East in Japan Yoshinao Fujii had, in 1847, described Katayama disease which hitherto was supposed to be an irritation caused by lacquer that had spread out into the water from a legendary capsized merchant ship. He recognised the typical itchy eruption, diarrhoea, distention of the abdomen, wasting and final ascites. He also noted that the farmers contracted the disease in water. Domestic animals were also affected. Fujii suggested that if the water and mud were analysed, the cause of the stubborn disease would be known and instant cure effected "just as ice melts".

Fujii's hopes were partly realised when Katsurada (1904) discovered some oval shaped ova containing ciliated miracidia in the stool of his patients. These ova differed from those of *Schistosoma haematobium* described in Egypt in being devoid of spines. Knowing that the disease also affected domestic animals, Katsurada looked for and found the worm he named *Schistosomum japonicum* in the hepatic portal system of a cat. He subsequently demonstrated the ova in the human intestinal wall.

The mode of transmission of the disease was studied by Fujianami and Nakamura (1909). They demonstrated in a controlled experiment using calves that infection was transmitted through the skin and that the risk was greater in stagnant dirty or muddy water than in a flowing river. The worm was observed to grow in the host's body very quickly and to start laying eggs by the 39th day.

Miyairi and Suzuki (1913) are credited with the discovery of the intermediate host. They recovered the ova from cow dung and watched the miracidia hatching from the egg shells. The miracidia were observed to be very active during the first two hours and to move like hungry tiggers when coming into contact with the snails. They penetrated the skin and later were seen as sporocysts settled in the gill slit or in the wall of the digestive apparatus of the snail. The cercariae released from the snails successfully infected a mouse. These snails, found only in the districts with Katayama disease, had easily crushable shells with 7 whorls and were apparently without lungs. In a later study, Miyairi and Suzuki (1941) produced more detailed description of the characteristics of the snail host and the development of miracidia within its tissue in the laboratory.

The impetus for intensive research in the West was revived when many of the Commonwealth troops stationed in Egypt were contracting the disease and news of the interesting discoveries in Japan had filtered through. Leiper (1915a) was hence despatched on a "Bilharzia Mission" to Egypt with a brief to work out the life cycle of the parasite and recommend means of its prevention and eradication. Within a short time he produced evidence that infection occurred by oral as well as cutaneous route. Leiper (1915c) traced the development of *Schistosoma* from ova through the intermediate stages up to the point of infection of the definitive host. He described the maturation process of the parasite in the liver of the definitive host in detail. The route followed by the cercarial body in transit from the point of entry to the portal system, however, remained unsolved.

Sir Patric Manson (1902) had observed a lateral spined *Schistosoma* ova in the stool of a patient from the West Indies and suggested that there could be two separate species of *Bilharzia*. The species producing lateral spined ova was named *Schistosoma mansonii* by Sambon (1907). Sambon (1909) later described more particulars of the *Schistosoma mansonii sambon*. But it was Leiper (1918) who actually proved that there were two separate human species of *Schistosoma* in Egypt. His animals infected with cercariae from snails of genus *Planorbis* produced eggs with lateral spines only while those infected with cercariae from *Bulinus* snails gave rise to parasites producing ova with terminal spines. Separate identity of *Schistosoma mansonii* and *Schistosoma haematobium* was thus established.

Schistosoma haematobium was recognised as a public health problem in Africa from Cape of Good Hope (Harley, 1864) to the Nile Delta as was also known to Lord Kitchener, who, quoted by Leiper (1915a), commented in 1913 "It is high time that serious steps should be taken to prevent the continuity of the infection that has been going on for so long in this country". This message, however, misfired in the interior of the Continent, as Mackey (1953) in a paper prepared as a basis for Medical Policy in East Africa dismissed *Bilharzia* as having a perfect host-parasite relationship. It is still the belief of many workers that *Schistosomiasis haematobium* is a less severe disease in East Africa than in Egypt.

Serious attention to the study of Bilharziasis in Africa was revived after the Second World War. The first joint OIHP/WHO study group on African Schistosomiasis was convened in Cairo between 24th and 29th October, 1949. Among the recommendations (WHO Chronicle, 1950), they stressed that "in many countries in which Schistosomiasis is endemic, evidence already available indicates that it is a public health problem second only to Malaria". The exact distribution of the disease was then not known although endemic and epidemic foci were known to be widespread in Africa, Asia and America. It was further noted that the methods of controlling Bilharziasis have in practice proved insufficient to check the epidemics even in Egypt where great efforts had been exerted. Research on the geographical distribution of bilharziasis and its vector snails was thus recommended, with the guide-line that "the knowledge to be obtained by such surveys is necessary to appreciate the social as well as the medical importance of the disease, to enable national and international health authorities to plan effective control measures".

The study group further recommended wider research in the importance of bilharziasis as a cause of death, morbidity and loss of productive capacity as well as susceptibility and immunity to infection with bilharzia. Since then, numerous publications on the epidemiology, molluscan hosts, treatment and, lately, immunology of bilharziasis have mushroomed in the literature. The treatment of the disease has largely been confined to chemotherapy. Surgery has received little attention. Even Makar (1955) maintained that the "battle between man and bilharzia should better be fought outside the human ground". Unfortunately the living worm in the tissue must be destroyed and the damage caused by it and its ova must be corrected.

In compliance with the recommendations of the working group on Schistosomiasis, Blair (1956) was commissioned by WHO to carry out a wide preliminary survey throughout the British West and East Africa, Nyasaland and Rhodesia. He found that informations on bilharziasis were generally scanty and incomplete and recommended further local studies in all areas affected.

In Tanganyika, now part of the United Republic of Tanzania, Blair found that it was known as early as 1911 that schistosomiasis haematobium was both heavy and widespread. He quoted Wolf who found 33.4% positives in 1000 urine samples examined in Lindi in 1911 and a survey of school children at Tunduru by Deck which showed 50% infection rate. He referred to the work done by Butler showing that 20% of 435 prisoners examined in Dar-es-Salaam in 1921 had haematobium infection and also noted that 30 - 40% of army recruits from the then Lake and Western Provinces were found to have infection of "mild type" in 1940. Blair further observed that 80% of the recruits from Maswa District were infected whereas those from Bukoba were remarkably free of schistosomiasis.

Dewhurst (1949) reported a rough tribal distribution of schistosomiasis in East Africa. He examined men of the King's African Rifles (K.A.R.) who were already accepted as fit for service and were due to go to South East Asia. Among the Tanganyika tribes found with high prevalence of schistosomiasis haematobium were Mwera, Makua, Digo, Ngurimi, Sukuma and Nyakusa.

In East Africa, the Medical Research Institute at Mwanza spearheaded the epidemiological investigations of bilharziasis. Webbe (1962) mapped out the known distribution of bilharziasis. He showed that schistosomiasis haematobium was endemic along the whole coast of the Indian Ocean and along the Eastern shores of Lake Victoria from Nyanza gulf in Kenya through Musoma to the Gulf of Mwanza. In addition, there were many pockets of endemic areas such as Tunduru, Mbeya, Dodoma, Machakos and the Northern shores of Lake Kloga in the hinterland. He observed that the principal snail host of schistosomiasis haematobium, the *Bulinus*, had predilection for small pools and seasonal water-courses. These snails demonstrated great ability to withstand dessication as well as flood conditions. Some snails were recovered from water-courses which had been dry for 12 weeks and were at times found buried 6 - 8 inches in damp mud.

Webbe (1962b) studied the ecology and habitat of the molluscan hosts and demonstrated the seasonal variation of snail population in an area of Bukumbi chiefdom, Mwanza District. The maximum population density of snails was observed soon after the rainy season. He labelled some snails with cobalt 60 and recovered them later, from a pool that was completely dry for 130 days, 7 days after it was refilled by rainfall. Hamsters exposed to the cercariae from these snails were found with adult worms 101 days later, thus proving that infection is carried by these snails from one rainy season to the next. The principal intermediate host was established to be *Bulinus nasatus productus*.

Transmission pattern of bilharziasis was shown to be related to seasonal variation in snail population density (Webbe, 1965). Maximum infection occurred soon after the rainy season. Webbe suggested this fact could be used as a basis for control by applying molluscicides just before the onset of the dry season. He also advocated chemotherapy to reduce the egg load and hence the number of miracidia available to infect a given population of snail hosts.

From the same Institute, Jordan (1961) conducted a bilharziasis survey in a Sukuma village and confirmed earlier belief that its prevalence rate was high. The prevalence rose to 78% in the age group 6 - 12 years. The older persons had 50% positive rate. In a further observation, Jordan (1965) recommended chemotherapy to complement snail control in reducing the high incidence of bilharziasis in the area. Jordan (1963) further noted that the control of schistosomiasis anywhere was difficult and in the Sukumaland it has been "well nigh impossible". As damage produced in the tissue was proportional to the egg load it was necessary to treat the infected persons and reduce the number of adult worms as early as possible. Forsyth (1963) however, differed by recommending treatment only for people who are not liable to be re-infected.

Similar studies were done in Egypt by Farooq and Nielsen (1966). They described details of the epidemiological techniques.

Farooq and Hairston (1966) emphasised the distinction between incidence and prevalence of a disease. The latter is a cross-sectional measure of the frequency of a disease at a given time while incidence is the rate of conversion from negative to positive over a space of time. Incidence was therefore recommended as the most sensitive parameter for assessing the success of any control measures. In Egypt bilharzia 49-project area, they found an incidence of schistosomiasis haematobium of 22.8% per year in the age group 0 - 6 years. This incidence, they noted was slightly lower than the true incidence because some became spontaneously negative at the rate of 0.47% per year in the age group 1 - 4 years.

Farooq et al (1966) demonstrated that in the Egypt 49-project area the prevalence of schistosomiasis haematobium increased rapidly up to the age of 14 years and then declined gradually to the age of 40 years after which it remained constant.

In Egypt, where large numbers of patients were receiving treatment for schistosomiasis at the Fouad 1st and Kasr-El-Ainy Hospitals, Makar (1955) accumulated extensive clinical data elucidating the urinary tract complications. Makar estimated that 60% of the residents of the Nile Delta and the areas of the Nile valley where perennial irrigation was practiced had schistosomiasis haematobium. He made a fair description of the pathological changes caused in the bladder, ureters, kidneys, seminal vesicles, prostate and the external genitalia. His interpretation of the observations, however, produced a few errors. For instance, he believed that when severe or repeated infection caused narrowing of vesicular veins and fibrotic changes were advanced, bilharzial worms failed to enter the bladder and found their way into ectopic sites which include the ureters, kidneys, seminal vesicles and prostate! He regarded sandy patches as being due to atrophy of the mucosa.

Makar rightly emphasised the importance of cystoscopy in the diagnosis and follow up of urinary bilharziasis. He recommended the use of endoscopic resection for biopsy but did not bring out the role of radiography adequately.

In his series, carcinoma of the bladder formed 43% of all neoplasms. The patients were significantly younger than other cancer patients. Out of the 360 patients he treated, 3 were under 20 years, 27 were between 20 and 29 years, and 110 were between 30 and 39 years of age. Histology revealed a 40% preponderance of squamous cell carcinoma. Anaplastic carcinoma formed 20% and columnar 10%.

Makar made authoritative description of the surgical treatment of ureteric stenosis and hydronephrosis. He warned against "athletic surgery" in bilharziasis adding that a kidney once already tainted by bilharzia, however good it might at first appear, is apt to deteriorate once the other side is removed.

Ferguson (1911) had reported a series of 40 cases of carcinoma of the bladder studied at post-mortem in Cairo. He observed that the frequency of the disease was in excess of known statistics from Europe and felt there must be a peculiar aetiological factor in Egypt. As all these cases had bilharziasis, he regarded the neoplasm as an irritation cancer. Fripp (1961) attempted to explain the pathogenesis of carcinoma of the bladder by the presence of a higher urinary glucuronidase in the bladder of patients with schistosomiasis haematobium. The cases with high egg count also had high enzyme titre.

Scott (1937) worked out the distribution of human schistosomes in Egypt and more recent work (Smith et al. 1974) showed that schistosomiasis haematobium was the primary cause of death in 10% of all patients with evidence of the disease and 42.7% of those with heavy infection.

In Rhodesia, now Zimbabwe, Honey and Gelfand (1960) studied 100 African and 300 European hospital patients and advanced the concept of "African bilharziasis" and "European bilharziasis" based on the chronicity and severity of infection. The Africans were seldom seen in the hospitals until serious complications had arisen. They had typical sandy patches, bilharzioma and papilloma. The Europeans were seen early in acute phase of the disease and exhibited symptoms of haematuria. At cystoscopy, tubercles were their commonest findings.

They attributed back pressure and hydronephrotic changes to increased intravesical pressure resulting from diminution in the bladder capacity. Carcinoma of the bladder was observed to be common among the Africans. They thought fibrosis of the ureteric wall caused both stenosis and dilatation.

Honey and Gelfand gave a good description of the cystoscopic appearance of the late lesions of bilharziasis but the cause of vesico-ureteric reflux, seen in 9% of the Africans, was not convincingly explained. Endoscopic dilatation was recommended as the treatment of choice for early strictures of the ureters and reconstructive operative procedures for the severe cases.

Buchanan and Gelfand (1971) showed that the calcification of the bladder seen on X-ray was confined to the ova and therefore indicated heavy infection.

The pattern of urological complications seen in Rhodesia, except for the failure to observe urinary calculi, is similar to the Egyptian experience. What about the rest of Africa? The answer to this question was to come from the Medical Research Institute in Mwanza and the University College Hospital in Ibadan, both situated in endemic areas.

Forsyth (1964) in a prevalence study at Usagara, Mwanza, found 94% of school children had positive schistosoma haematobium ova in their urine. Urological abnormalities were demonstrated in over 20% of the urograms and the frequency rose to 30% in the older children.

Forsyth and MacDonald (1965) gave further details of the findings. The prevalence of schistosomiasis was actually found to be as high as 100% in standard 4 children and urological abnormalities were present in 37% of standard 6 pupils. These lesions were regarded as being irreversible. It was also established that the lesions: calcified bladder, deformity of the ureters and hydronephrosis were related to the weight of infection. Deformity of the ureters occurred in 10.3%, hydronephrosis in 9.2% and non-functioning kidney in 0.3%.

A similar study carried out at Donge, Zanzibar, (Forsyth and MacDonald, 1966) showed that abnormal urograms were present in 17% of the children. There was no evidence of reversal of the changes after apparent cure by treatment. They sought to regard hydronephrosis as a sequel and not a complication of Schistosomiasis.

In a survey of the complications of bilharziasis in an unselected population at Bukumbi, Forsyth and Bradley (1966) found hydronephrosis, ureteric lesions and non-functioning kidneys in over 20% of the children and 10% of the adults. The over all prevalence of the Schistosomiasis haematobium was 42%. They commented that the morbid changes following this disease were not overt, even in the severe cases, and may easily be overlooked in the absence of elaborate diagnostic facilities. They concluded that Schistosomiasis haematobium was a great public health and medical problem in Tanzania.

In a longitudinal study of a Zanzibar community, Forsyth (1969) found an over all prevalence of Schistosomiasis haematobium to be 65.1%. The range in children aged 7 - 17 years was 90% to 100%. In all, 35.4% had urological abnormalities on intravenous pyelograms.

In Ibadan, Gilles et al (1965a) found a prevalence of Schistosomiasis haematobium of 91% in primary school children. Half of the positives had abnormalities on intravenous pyelograms. The commonest radiological changes were nodular filling defects. Ureteric deformities were surprisingly very rare. Gilles et al (1965b) found that 50% of the Boatyard workers at Epe had bilharzial ova in their urine and 39% of them had abnormal urograms. At cystoscopy sandy patches, pallor of the mucosa and papillomata formed the most frequent observations. Although the populations studied in both cases were small, the results confirm that Schistosomiasis haematobium is an important cause of complications.

Lucas et al (1966), in a preliminary report, showed that there was a significant reversal of radiological changes of the bladder and the ureters after drug treatment of the children. They recommended further work to determine the scope and limitations of chemotherapy.

The results of drug treatment in Egypt (Farid et al. 1966) were a little disappointing as far as reversal of the radiological lesions were concerned, but Lucas and Cockshott (1966) argued that children respond better than adults.

Bhawandeen (1967) threw light on the nature of the ureteric lesions. He distinguished between acute lesions and chronic lesions. The acute ureteric lesions are flat topped granulomatous or pseudotuberculous changes containing numerous ova in all layers and having extensive eosinophilic infiltration plus necrosis. Muscle destruction and early fibrosis are also conspicuously present. In the chronic lesion, either a focal segment or an entire length of the ureter is involved and rigidity of the affected part is marked. Histopathology shows mainly calcified ova in all layers, extensive muscle destruction and consequent fibrosis with minimal cellular reaction. He also noted that ureteric changes are more common at autopsy than normally clinically appreciated.

The acute lesions are expected to respond to drug treatment. Further work is required to establish the clinical criteria for recognising the two stages of ureteric lesions.

Presumptive evidence of human immunity to Schistosomiasis was presented when Fisher (1934) discovered an entirely new human species of *Schistosoma* which he named *Schistosoma intercalatum* because it occupies an intermediate position in physical features between *S. haematobium* and *S. bovis*. The new worm causes gastrointestinal symptoms and seems to have geographical distribution confined to West Central Africa. Prevalence of infection was as high as 96% in the children but adults exposed to the same village conditions became free from the disease between the age of 30 and 35 years. This strongly supports the theory of acquired immunity. Fisher confirmed his observation by exposing two human volunteers aged 35 and 45 years to water containing cercariae of these schistosomes and they were not infected. On the contrary, mice similarly exposed to water from the same source were all harbouring the schistosomes when killed 60 days later.

Smithers and Terry (1967) demonstrated that a single exposure of 2 rhesus monkeys to as few as 25 normal cercariae of *Schistosoma mansoni* was sufficient to induce resistance to subsequent challenge 17 weeks later. Exposure to 20,000 irradiated cercariae failed to confer immunity. They further established that transferring adult worms into the hepatic portal system of monkeys conferred immunity.

Nelson et al (1968), however, argued on epidemiological and experimental evidence, that heterologous immunity resulting from exposure to bovine or other animal *Schistosoma* might be of importance in limiting the severity of *Schistosoma* infection in some parts of the world. This process referred to as "zooprophylaxis" has so far not been demonstrated to satisfaction. Wright and Bennet (1967) on the other hand endeavoured to show by laboratory studies that strains of *Schistosoma haematobium* from different places behave differently in the hamster.

The clinical presentation and diagnosis of Schistosomiasis were well reviewed by Manson-Bahr (1958). The majority, 60%, had eosinophilia. Regarding cystoscopic appearance, Kirkaldy Willis (1960) gave a full description of the lesions, accompanied by hand drawings. He regarded inflammation around the ureteric orifices and general hyperaemia of the mucosa as early signs. Bulla formation, tubercles and granulomatous polyps then follow in that order. Chronic mucous cystitis occurred late, preceding the onset of complications which included haemorrhage, diverticula, changes of the ureteric orifices and malignant transformation.

McMahon (1976) recently reviewed the history of chemotherapy of bilharziasis ranging from the antimonials, lucanthone, niridazole, hycanthone to oxaminquine. The detail of dosage and side effects of these drugs which include the popular ambilhar (niridazole) and etrenol (hycathone) are set out by Maegraith (1971), and Wilcocks and Manson-Bahr (1972). Efficacious treatment to prevent further damage to tissues is now available even if the drug that meets all the criteria for suitability for mass chemotherapy is not yet developed.

After the comprehensive work of Makar, referred to earlier, there have been some important clinico-pathological reports. Honey (1968) described the pathological changes in bilharziasis and summarised that fibrous contracture of the bladder, stricture of the ureter and carcinoma of the bladder were the complications of schistosomiasis which required surgical intervention.

Operation was indicated in cases of bladder contracture with severe pain, intolerable frequency and hydronephrosis. He treated ureteric stricture by endoscopic meatotomy, excision with re-implantation, ureteroileocystoplasty or bladder flap procedures. Nephrectomy was recommended where there was little or no renal function. His results were good, accepting vesico-ureteric reflux. He followed basically the standard regime for the treatment of carcinoma of the bladder but observed that the growth frequently occurred in small fibrotic bladders and that the patients presented late. Total cystectomy, partial cystectomy and radiotherapy were mentioned. Small fibrotic bladder with neoplasm, early tumour and palliation of "late fixed" carcinoma were the indications of total cystectomy. The limitations and complications of the procedures were not discussed.

Weinberg (1970) reported four cases of bilharzial ureteric stenosis treated by ileal loop replacement with "satisfactory" functional results. One aged 36 died post-operatively. The survivors were all children; one aged 12 and two aged 14 years. He recommended adequate excision of the diseased ureter.

From Egypt, Ghoneim et al. (1971) reviewed a series of 21 cases of bilharzial ureteric strictures presenting with anuria. They were treated by preliminary nephrostomy. Uretero-vesical reimplantation formed the majority of the subsequent definitive repairs. It is noteworthy that 11 of these patients had had nephrectomy of the contralateral kidneys. They recommended caution in considering nephrectomy.

Amin (1976) presented his experience of the use of isolated ileal loops in the replacement of stenotic ureters, the majority of which were bilharzial, and concluded that it provided satisfactory solution to the problem of replacement of extensive ureteric defects. He discussed the operative details. His cases appeared to be remarkably free of the risk of dilatation and redundancy of bowel segments, residual urine, urinary infection, stone formation and

progressive deterioration of upper urinary function warned by Tanagho (1975).

Weinberg (1976) reported a case of the use of appendix in ureteric replacement and suggested it could be a useful alternative procedure. This report, like the others on operative surgery of bilharziasis, lacks a clear indication for the procedure. "The correct operation, even if clumsily performed, is much more likely to be successful than the wrong operation, however brilliantly executed" was the advice given by the great surgeon, Grey Turner (1955).

CHAPTER 11

INTRODUCTION

The land

The Sukumaland is a plain about 1070 meters in altitude stretching from the shores of Lake Victoria southwards to Nzega, 115 kilometers north of Tabora and from the eastern part of Geita District to the Serengeti plain. It includes most of Mwanza Region, the whole of Shinyanga Region and part of Nzega District of Tabora Region. This land was occupied by many rival chieftains loosely united under a tribal banner in the pre-colonial era.

As was well described by Webbe (1962) the striking geological features include the predominance of the "black cotton" soil with scattered boulders of granite rising to break the horizon. Rainfall averaging 76 - 100 cm. a year pours between November and May leaving the rest of the year dry. The vegetation, consisting of short grass and scanty bushes dotted with imposing baobab trees, tend to wither during the dry season. But, as the soil is relatively impervious and the water table is high, the small pools forming important habitats for the bulinus persist and the river beds remain damp enough for hibernation of these snails. Figure 1 shows the typical habitat for *Bulinus nasatus*.

The People

The wasukuma, a tribe of Bantu ethnic origin number about 3 million people. They live in organised villages, each consisting of at least 250 homesteads. The houses are well laid out on one acre plots sited around public amenities (e.g. schools, dispensaries, water supply etc.).

The village is administered by Chama Cha Mapinduzi (C.C.M.) which is not only the sole political party but also the *de facto* social organisation. All adult residents participate in planning the welfare services by being members of the village assembly and through the village council. The latter is a representative legislative body. An elected village Chairman, aided by Ten House leaders (Balazi), is responsible to the Ward Secretary (Katibu Kata). A Ward is an administrative unit made up of several villages.

Subsistence farming and livestock keeping form the main occupation in the villages. Cotton, maize, millet and rice are the staple crops. Individual families have their own shamba though communal work is encouraged as a prerequisite towards Ujama (communal life in Swahili). The Wasukuma own large herds of cattle, goats and sheep which struggle for the few grass and shrubs in this semi-arid land.



Figure 1: Water dam: a typical habitat for *Bulinus* Snails.

Water Contact Activities

The water contact habits are not very different from those described by Farooq and Mallah (1966) in Egypt. Children of both sexes enjoy wading and swimming in water particularly in the heat of the sun and when taking the herds to drink. The adult female comes into contact with water when drawing water for domestic use, washing clothes and taking baths. The adult males, particularly young adults, also take baths at the source of water. Paddy fields form an important point of contact as both men and women participate in transplanting, weeding and harvesting rice. Hence, nearly all age groups come into contact with water harbouring infected snails.

Life Cycles of Schistosoma Haematobium

Man acquires *Schistosoma* through the skin during physical contact and through mucous membrane when drinking water into which infective larvae, the cercariae, have been shed by the snails. The cercariae penetrate into the tissues and, via venous pathways, reach the liver where they mature. Mating probably occurs in the portal system before the males, with the females enclaved in their gynaecophoric canal, migrate into the tributaries of the inferior haemorrhoidal veins and vesical plexus. The eggs are laid into the tissue of the hind gut, lower urinary tract, genital tract and a variable length up the ureters. It is at these sites that the physiological reaction to the presence of the worm and ova leads to pathological lesions. Some ova get through into the urine and stool and, on reaching water within about one month, hatch into miracidia. The miracidia that penetrate snails of the genus *Bulinus* enter a multiplicative development phase. Numerous infective cercariae are thus generated and the cycle is maintained (Maegraith, 1971; Davey and Wilson, 1971; Wilcock and Manson Bahr, 1972).

Control Measures

The control of bilharziasis involves disruption of the life cycle at vulnerable stages as was advocated by Leiper (1916) who suggested destruction of the cercariae and the molluscan hosts. At that time there were no effective drugs for the treatment of the definitive host. Subsequently, McMullen and Harry (1958) outlined the principle of control based on (a) health education and sanitation (b) snail control and (c) treatment of patients. To these may be added the possibility of immunological control.

Health education to prevent contamination of water by man and change water contact habits is a slow process in the third world where mass media are rudimentary. Likewise, improvement of sanitation aimed at eliminating the numerous snail habitats, constructing hygienic swimming pools and providing treated domestic water is not feasible in the countryside.

McMullen et al (1962) considered that the drugs available for mass treatment tended to be toxic and difficult to administer. The situation has, however, become more hopeful with the development of safer and more economical oral anti-schistosomal drugs like

Niridazole (Ambilhar) , Metrifonate (Trichlorphon) and Praziquantel (Embay 8440).

During the last two decades, much progress has also been made in immunodiagnosis (Kegan and Pellegrino, 1961) and immunopathology (von Lichtenburg, 1962; Andrade et al, 1961; Warren, 1972) but lack of full knowledge about the mechanisms controlling the host's immune response and the schistosome's means of circumventing immunity hampered the development of preventive immunity. The isolation of species specific schistosome antigens by affinity chromatography technique (Senft and Madisone, 1975) and the realisation that granulomatous reaction is an immunological response (Boros and Warren, 1970; Kelly et al., 1976) will facilitate further investigations. Once the question why adult worms induce immune response which destroys invading schistosomula (Smithers and Terry, 1967) while the adults themselves prosper is answered, the cherished goal of immunisation by vaccination should be in sight.

Total eradication of schistosomiasis in Africa is therefore unlikely in the foreseeable future, particularly as extension of irrigation schemes to solve food shortage caused by prolonged drought is inevitable.

The Problem

Although much progress has been made in the field of epidemiology, immunology and chemotherapy, further assessment of the resulting urological lesions (reversible and irreversible) in the population of endemic areas is essential for the understanding of the medical and public health importance of the disease. The diagnosis of the irreversible lesions and the place of surgery in the correction of the lesions so as to arrest further functional deterioration also need reappraisal. This work is an endeavour to combine an epidemiological survey and clinical methods to elucidate the surgical problems being created by *Schistosoma haematobium* in the Sukumaland.

CHAPTER 111

OBJECTIVES.

There are 3 major objectives of this study:

1. To investigate the incidence of urological complications of Schistosomiasis haematobium in a population of a known endemic area;
2. To assess the value of clinical, laboratory and radiological investigations in the diagnosis of the urinary tract damage and the selection of patients for surgery;
3. To establish the place of operative surgery in the management of irreversible complications of Schistosomiasis baematobium.



Figure: 2

Urine samples were collected between 11 a.m. and 2 p.m. in 200 mls wide-mouth plastic containers with tight fitting lids. Personal particulars (name, age, sex, village and ten cell) were recorded in the survey sheet and each urine sample preserved by adding three drops of 10% formalin. The samples were transported to Williamson Diamonds Mine Hospital, Mwadui, for examination.

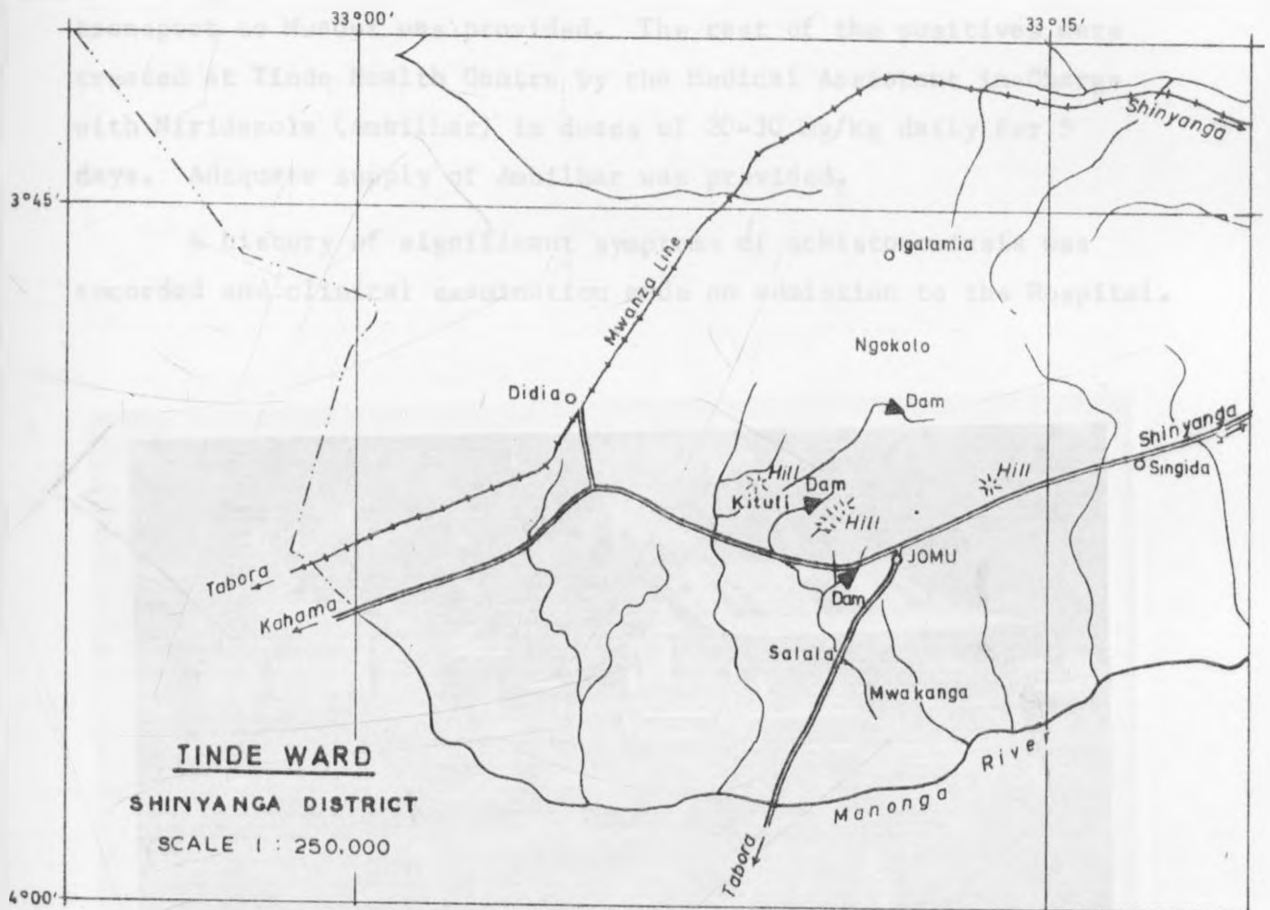


Figure 3

Quantitative determination of the *Schistosoma haematobium* ova load in the urine samples was done by the centrifuged deposit method because the specialised equipments required for the more accurate Bradley's filtration method were not available. The sample was first vigorously shaken, then 10 mls was poured into a graduated centrifuge tube and centrifuged at 1500 r.p.m. for 3 minutes. After discarding the supernatant the remaining 0.2 mls of deposit was examined in a counting chamber.

The results and the personal particulars of the subjects were punched on computer cards for analysis using I.B.M. system 11 Computer.

(b) A Clinical Study of a randomised sample, one in ten of the positives, was carried out at Mwadui Hospital. The selected people were notified through their village C.C.M. Chairmen and transport to Mwadui was provided. The rest of the positives were treated at Tinde Health Centre by the Medical Assistant in-Charge with Niridazole (Ambilhar) in doses of 20-30 mg/kg daily for 5 days. Adequate supply of Ambilhar was provided.

A history of significant symptoms of schistosomiasis was recorded and clinical examination made on admission to the Hospital.

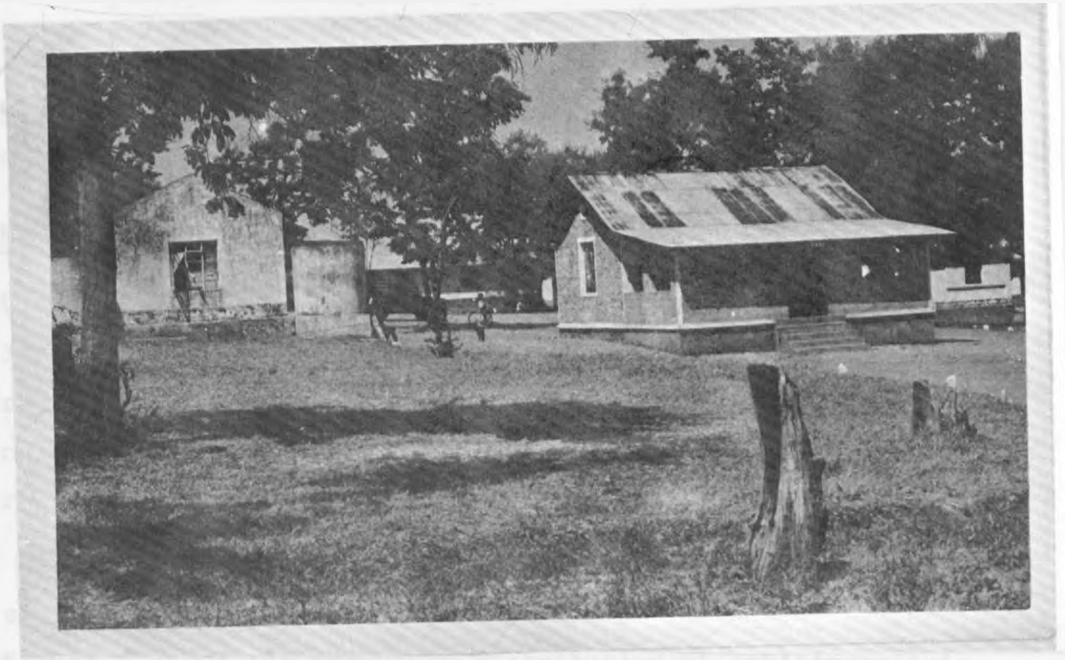


Figure 4: Tinde Health Centre

Particular attention was paid to hepatosplenomegaly, renal enlargement and tenderness over the bladder. The following investigations were then carried out:-

1. Stool microscopy for *Schistosoma mansoni* using Kato's thick smear method.

2. Haematological examinations: haemoglobin, white cell count (total and differential) and erythrocyte sedimentation rate (ESR).
3. Culture of the midstream sample of urine and determination of sensitivity of the isolated organisms to antibiotics.
4. Blood urea and serum creatinine determination by colorimetric method.
5. Intravenous pyelography (I.V.P.), using urografin 76% as the standard contrast medium and films exposed at 5, 10, 15 and 25 minutes.
6. Cystoscopy under general anaesthesia. Particular note was made of the bladder capacity, type of bilharzial lesions and state of the ureteric orifices. Representative lesions were biopsied for histopathology.

The patients were then treated with Ambilhar for 5 days as above. Transport back to the villages was provided on completion of treatment.

RESULTS

(a) During the field survey urine samples were collected from 3687 people of whom 1820 were females and 1867 males. Their age range was 2 to 90 years, with a mean of 15.5 years. Thirteen children younger than 2 years provided urine samples but the results were not included in the study.

Schistosoma haematobium ova were present in 1921 urine samples giving an overall prevalence rate of 52.1% (Table 1). Figure 5 shows the frequency distribution of schistosomiasis haematobium in Tinde population by age group.

The youngest person with schistosomiasis infection was a baby 7 months old (not included in the analysis) and the oldest was 90 years.

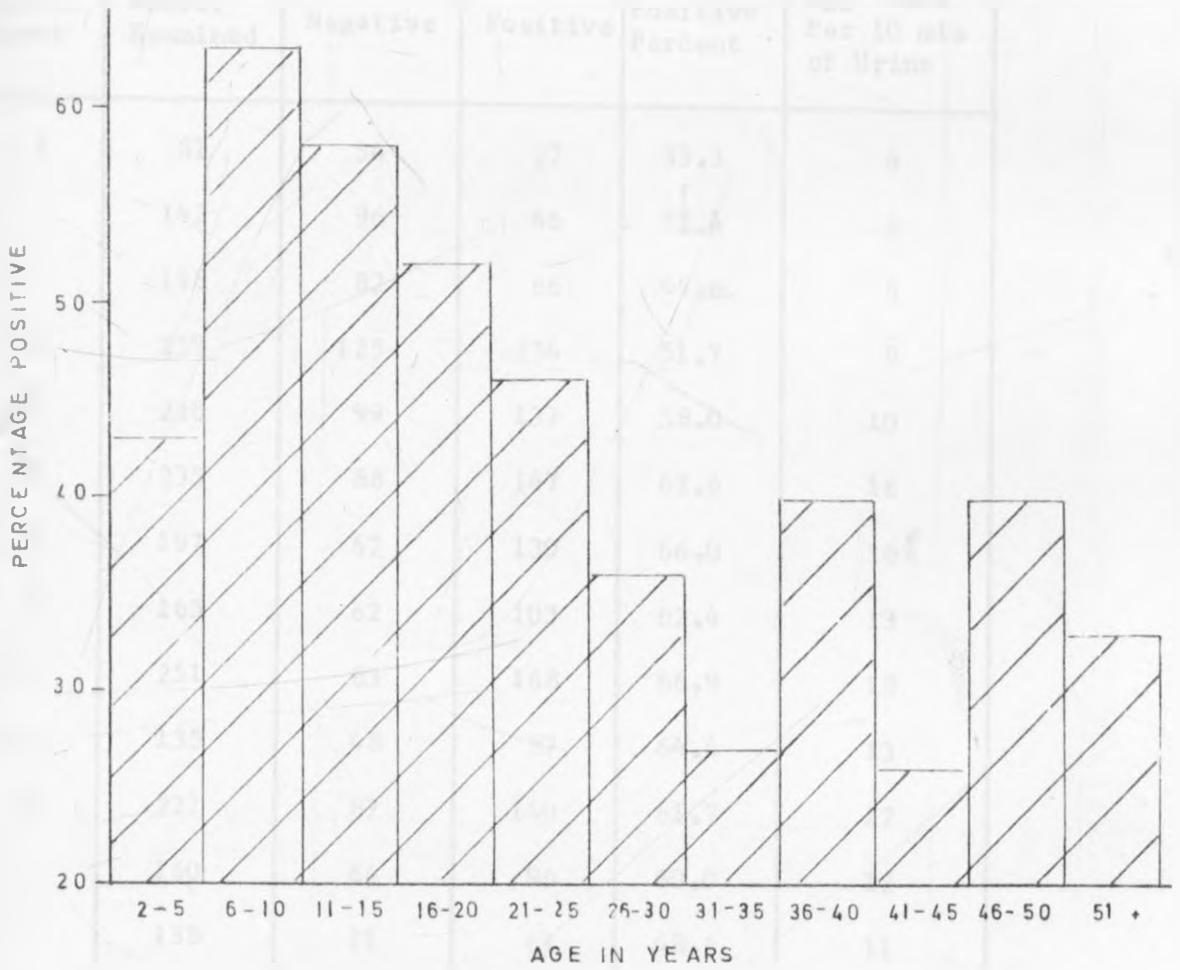
Table II gives the frequency of schistosomiasis haematobium and egg load in urine by year age from 2 to 20 years.

T A B L E I

FREQUENCY OF SCHISTOSOMIASIS IN
RELATION TO AGE GROUPS

Age in Years	Number Examined	Negative	Positive	Rate of Positive Percent
2 - 5	631	358	273	43.3
6 - 10	1084	399	685	63.2
11 - 15	793	328	465	58.6
16 - 20	412	198	214	51.9
21 - 25	147	79	68	46.3
26 - 30	225	145	80	35.6
31 - 35	84	61	23	27.4
36 - 40	94	56	38	40.4
41 - 45	31	23	8	25.8
46 - 50	80	48	32	40.0
51 ⁺	106	71	35	33.0
Total	3687	1766	1921	52.1

Fig.5 FREQUENCY OF SCHISTOSOMIASIS HAEMATOBIIUM
IN RELATION TO AGE GROUPS



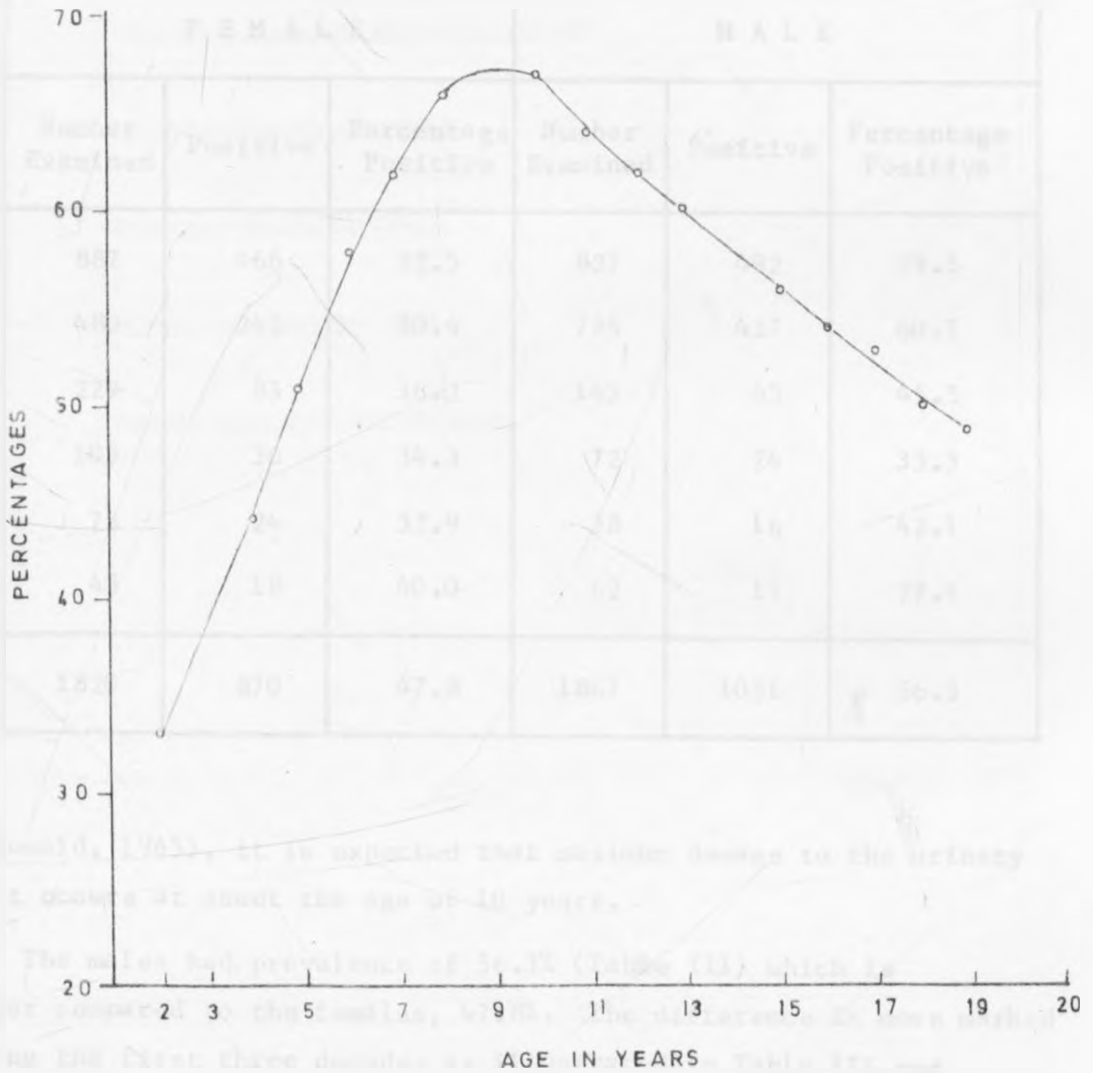
T A B L E II

FREQUENCY OF SCHISTOSOMIASIS HAEMATOBIIUM AND
EGG LOAD BY AGE FROM 2 TO 20 YEARS

Age in Years	Number Examined	Negative	Positive	Positive Percent	Egg Count Per 10 mls of Urine
2	81	54	27	33.3	4
3	142	96	46	32.4	4
4	148	82	66	44.6	4
5	259	125	134	51.7	9
6	236	99	137	58.0	10
7	235	88	147	62.6	16
8	197	67	130	66.0	16
9	165	62	103	62.4	13
10	251	83	168	66.9	18
11	135	48	87	64.4	13
12	227	87	140	61.7	12
13	160	64	96	60.0	12
14	138	71	67	48.6	11
15	133	58	75	56.4	10
16	125	58	67	53.6	12
17	79	37	42	53.2	7
18	70	35	35	50.0	9
19	45	23	22	48.9	8
20	93	45	48	51.6	5

Fig. 6

FREQUENCY OF SCHISTOSOMIASIS HAEMATOBIIUM
DURING THE FIRST 20 YEARS



At 2 years, 33.3% of the children were infected. The prevalence of infection rises to 51.7% at 5 years and to a maximum of 66.9% at the age of 10 years. Then, as illustrated in figure 6, there is a gradual decline signifying negative conversion which, actually, continues until a steady level is reached in the second half of the third decade.

The highest egg count which signifies heaviest infection was recorded at the age of 10 years. Since it was established that the degree of tissue damage caused by the bilharzial worm and ova is proportional to the weight of infection (Forsyth and

T A B L E III

SCHISTOSOMIASIS HAEMATOBIIUM IN FEMALES AND MALES
BY AGE GROUPS

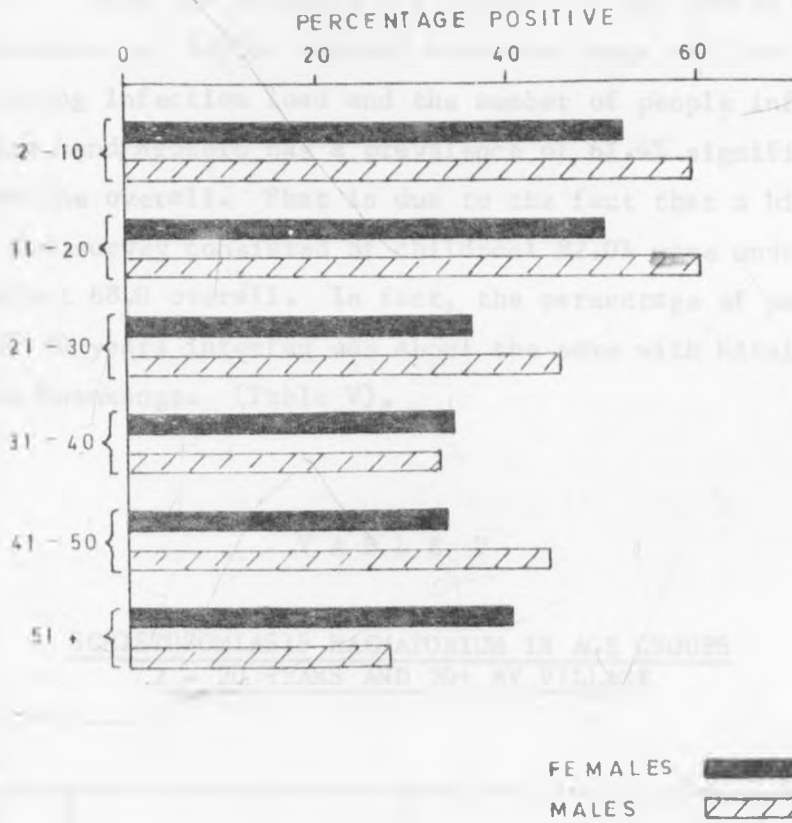
Age in Years	F E M A L E			M A L E		
	Number Examined	Positive	Percentage Positive	Number Examined	Positive	Percentage Positive
2-10	887	466	52.5	827	492	59.5
11-20	480	242	50.4	725	437	60.3
21-30	229	83	36.2	143	65	45.5
31-40	105	36	34.3	72	24	33.3
41-50	73	24	32.9	38	16	42.1
51 ⁺	45	18	40.0	62	17	27.4
Total	1820	870	47.8	1867	1051	56.3

MacDonald, 1965), it is expected that maximum damage to the urinary tract occurs at about the age of 10 years.

The males had prevalence of 56.3% (Table III) which is higher compared to the females, 47.8%. The difference is more marked during the first three decades as illustrated in Table III and figure 7. Enquiries into the possible factors responsible for the difference revealed that male children are more exposed to outdoor activities. They are primarily responsible for grazing the cattle and goats and are fond of swimming in the snail harbouring ponds.

Fig.7

SCHISTOSOMIASIS HAEMATOBIMUM IN FEMALES AND MALES BY AGE GROUPS



Comparing the percentage of people infected by village shows that Jomu and Nsalala have 45.2% and 42.3% respectively, lower than the other three villages.

T A B L E IV

SCHISTOSOMIASIS HAEMATOBIMUM IN TINDE POPULATION BY VILLAGE

Village	Number Examined	Negative	Positive	Percentage Positive
Kituli	1158	550	608	52.5
Ngokolo	699	270	429	61.4
Mwankanga	870	405	465	53.4
Nsalala	504	291	213	42.3
Jomu	456	250	206	45.2

These two villages are closest to the Health Centre and the residents get better treated when the drugs are available, thus reducing infection load and the number of people infected. On the other hand, Ngokolo has a prevalence of 61.4% significantly higher than the overall. That is due to the fact that a higher proportion of the survey consisted of children: 82.0% were under 15 years against 68.0 overall. In fact, the percentage of people older than 20 years infected was about the same with Kituli and less than Mwankanga. (Table V).

T A B L E V

SCHISTOSOMIASIS HAEMATOBIIUM IN AGE GROUPS
2 - 20 YEARS AND 20+ BY VILLAGE

Village	2 - 20 Years	Over 20 Years	Overall % Positive
Kituli	57.0	40.8	52.5
Ngokolo	62.8	41.3	61.4
Mwankanga	55.1	46.3	53.5
Nsalala	52.6	22.9	42.3
Jomu	47.6	30.8	45.2

(b) CLINICAL FEATURES

Clinical investigation of the randomised sample of Kituli and Nsalala residents has been completed. Out of the total of 821 positives, 78 were admitted to the Hospital but 3 had to be eliminated because they were in the first trimester of pregnancy and were therefore not to be X-rayed. Four others included in the sample were not admitted to the hospital either because they

had visitors or were temporarily absent from the village at the time transport arrived. The non-response rate was thus 8.5%.

Seventy five people, 36 females and 39 males were investigated. Their age range was 2 to 76 years with a mean of 22.4 years. The results of the investigation are given below.

1. Symptoms

Schistosomiasis haematobium is a known disease in the Sukumaland and the symptoms are well recognised by the population but little attention is paid because all adolescents are expected to have the disease. Table VI shows the frequency of occurrence of the symptoms in the 75 people.

T A B L E VI

FREQUENCY OF SYMPTOMS RECORDED

Symptoms	Number of people	Percentage with Symptoms
Haematuria	39	52.0%
Suprapubic pain	21	28.0%
Dysuria	11	14.7%
Loin pain	2	2.7%
Asymptomatic	21	28.0%

Haematuria was complained of by 52.0% of the people. Suprapubic pain in association with haematuria was a presenting symptom in 28.0% of the cases, and dysuria in 14.7%. Twenty eight percent of the people were completely asymptomatic. The younger people tend to have more symptoms.

2. Physical Signs

The physical signs elicited are shown in Table VII. Tenderness in the suprapubic region was a common finding in children whereas in adults it was present only in association with superimposed bacterial cystitis. Splenomegaly and hepatomegaly, present in 24.0% and 10.7% respectively, were probably incidental findings as other features of portal hypertension were absent. Three people had systemic hypertension but it was not established if this was of renal origin.

Thirty four people (45.3%) had no abnormal physical findings.

T A B L E VII

FREQUENCY OF OBSERVATION OF PHYSICAL SIGNS

Physical Signs	Number of People	Percentage With Signs
Hypogastric tenderness	11	14.7
Splenomegaly	18	24.0
Hepatomegaly	8	10.7
Loin Tenderness	1	1.3
Hypertension	3	4.0
No signs	34	45.3

3. Schistosomiasis Mansoni

Four people had *Schistosoma mansoni* ova in their stool i.e. 5.3% prevalence of double infection. This is much lower than expected along the shores of Lake Victoria. Forsyth and Bradley (1966) reported 24% in Mwanza.

4. Haematological Values

Haemoglobin values ranging from 6.9 g to 13.9 g with a mean of 10.1 g per 100 mls, were recorded. As other studies have shown that patients with haemoglobin higher than 7.4 g are not considered to be anaemic in Tanzania (Mtimavalye, 1978), anaemia is not a feature of schistosomiasis haematobium.

Eosinophilia without leukocytosis was present in 51.1% of the people investigated. This is consistent with the 60% reported by Manson-Bar (1958) and supports the theory that eosinophils are important in the defence of the body against parasites as they have been observed to exhibit cytotoxic activities in vitro (Butterworth, 1978). Eosinophil rather than monocyte infiltration is also constantly prominent around dead schistosomula in the tissues.

5. Bacteriological findings

Seven patients (9.3%) had bacteriuria.

The organisms isolated were as follows:-

Escherichia coli	4
Streptococcus faecalis	2
Staphylococcus aureus	1

Although figures from normal control are not available, this study suggests that bacterial infection is not commonly associated with schistosomiasis haematobium. Pi-Sunyer et al. (1961) at Ibadan also found that there was no significant difference in the incidence of urinary infection between the bilharzial ova positives and ova negatives.

Desquamated epithelium and a trace of albumen were common findings. Phosphatic crystals were frequently present in the centrifuged deposit of urine.

6. Renal Function Test

Facilities were available for determining blood urea and serum creatinine only. No person had a raised blood urea. Their

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blood urea values were ranging from 20 to 30 mg/100 mls and the mean was 26 mg/100 mls. The serum creatinine readings of 0.55 mg to 1.60 mg/100 mls, mean 0.95 mg/100 mls, were all within normal range. It is, therefore, apparent that blood urea and serum creatinine remain normal until late in the course of the disease.

7. Intravenous Pyelogram

Intravenous pyelogram (I.V.P.) was found to be the most useful single investigation for the assessment of the effects of schistosomiasis on the urinary tract. Besides the gross urological lesions usually reported (Forsyth and MacDonald, 1965), minor defects of the ureters were very common. Radiological abnormalities were detected in 52 out of 75 people investigated, a prevalence rate of 69.3%. Table VIII shows the distribution of the various defects found in 75 intravenous pyelograms done.

T A B L E VIII

DISTRIBUTION OF RADIOLOGICAL ABNORMALITIES
OF THE URINARY TRACT IN 75 I.V.P.

Lesion	I.V.P. Affected	Percentage Affected out of 75
Ureteric lesions	47	62.7
Bladder filling defects	14	18.7
Bladder calcification	6	8.0
Urinary tract calculi	5	6.7

Ureteric lesions, seen in 62.7% of the 75 intravenous pyelograms done, were the commonest abnormalities observed. Their appearance had several characteristics.

(a) Filling defects protruding into the lumen of the ureter suggestive of granulation tissue. These were observed exclusively in children below 15 years. Figure 8 demonstrates a filling defect in the pelvic course of the right ureter.

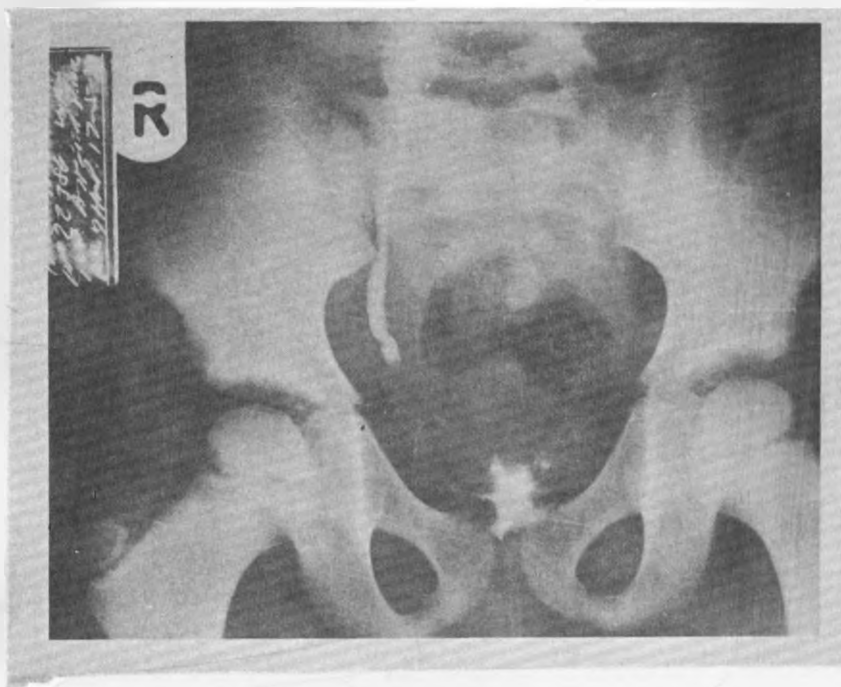


Figure 8: Post micturition I.V.P. picture of a boy aged 5 years showing a filling defect in the lower third of the right ureter. Note the hold up of the contrast medium.

It will also be noticed that despite the hold up of the contrast medium in the right ureter, figure 9 shows that there is no hydronephrosis or dilation of the pelvi-calyceal system.

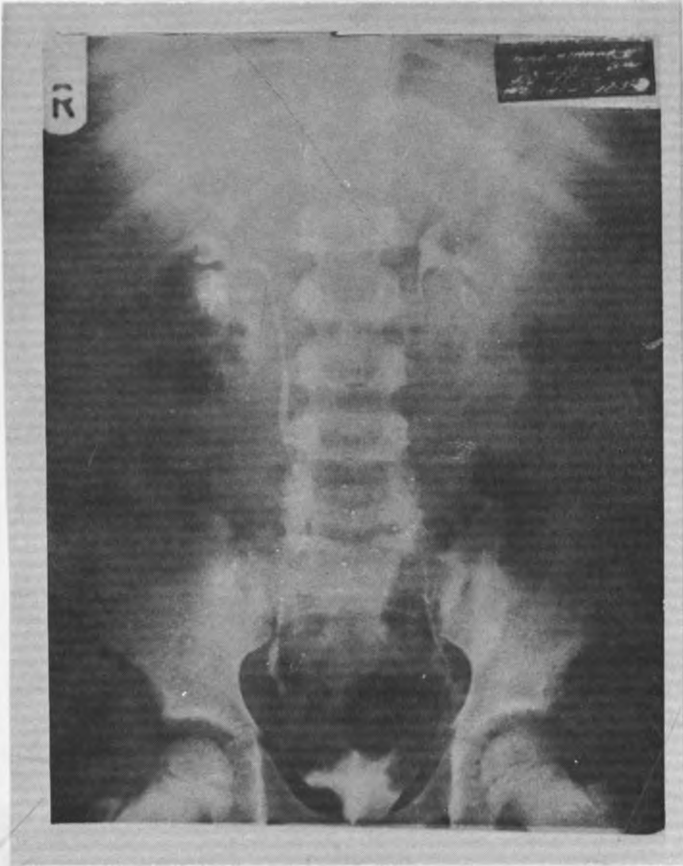


Figure 9: Despite the ureteric lesion on the right side there is no hydroureter and hydropelvis.

(b) Annular stenoses which, if multiple, give rise to beaded appearance. Figure 10 shows bilateral strictures of the lower end of the ureters and beading of the lower few centimeters of the right ureter due to multiple annular stenoses. Proximal ureteric dilatation is marked on the left side. The beading is well demonstrated by retrograde pyelogram (Figure 11).

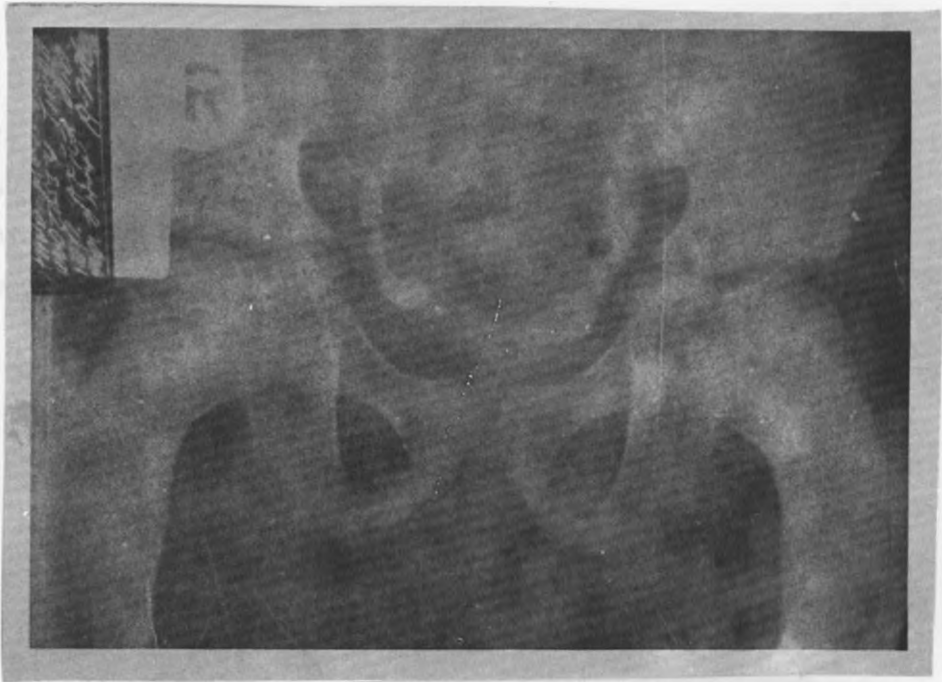


Figure 10: Stenoses of the lower end of both ureters in a boy aged 10 years. Annular stenoses are present on the right side while the left is markedly dilated.



Figure 11: Retrograde pyelogram in a 30-year-old female showing multiple stenoses of the left ureter and hydronephrotic changes.

(c) Gradual narrowing of the ureter to strictures of varying lengths. The right ureter is shown to be tailed off to a stenosis in Figure 12. The walls of the stenosed segment of the ureter may appear irregular.



Figure 12: Gradual narrowing of the ureters to the point of stricture best demonstrated on the right side. Note the bladder filling defects at the base and right lateral wall.

The commonest site of the ureteric lesion was found to be the distal third (pelvic course) but occasionally the middle third (Figure 13) and rarely the proximal third are affected.



Figure 13:
I.V.P. of an
11-year-old girl
with stenoses of
the lower third
of the left ureter
and the middle
third of the right.

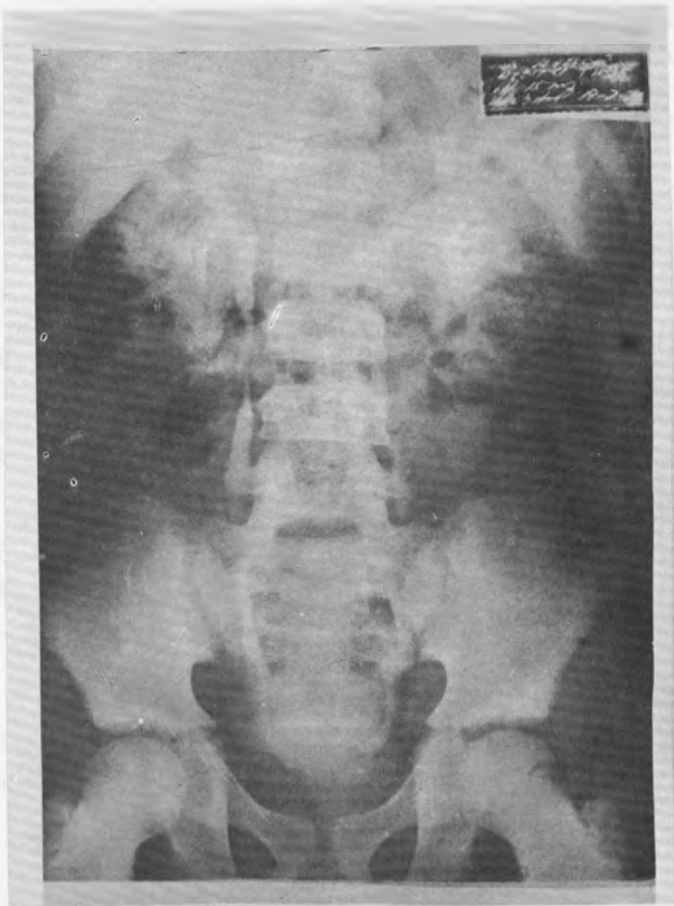


Figure 14:
Multiple ureteric
stenoses with skip
areas which are
dilated in a
10-year-old girl.

Skip areas of normal ureteric tissue, liable to become dilated, may interpose stenotic parts as shown in figure 14. The ureters are usually involved bilaterally but one side may be worse than the other.

The significance of these lesions is best appreciated by studying the back pressure they produce on the proximal urinary tract. Four grades of lesions are recognised (Table IX). Grade I lesions are those which have not caused proximal ureteric dilatation. They were seen in 37.3% of the people.

T A B L E IX

DISTRIBUTION OF THE GRADES OF LESIONS IN
75 INTRAVENOUS PYELOGRAMS

Grade of Ureteric Lesions	Number of Lesion Observed in 75 Persons	Percentage Affected
I Ureteric lesion without proximal dilatation	28	37.3%
II Ureteric lesion with proximal dilatation only	13	17.3%
III Ureteric lesion with proximal dilatation plus hydronephrosis	6	8.0%
IV Non-functioning kidney	0	0

Grade II lesions are associated with hydroureter without clubbing of the calyces (figure 15). Thirteen persons (17.3%) had grade II lesions. Grade III lesions have proximal hydroureter

and hydronephrosis (figure 16). They were seen in 8% of the people in this series.



Figure 15: Bilateral stenoses of the lower half of both ureters in an 8-year-old boy. The right ureter is dilated but the calyces are normal.



Figure 16: Stenosis of the lower half of the right ureter with proximal hydronephrosis, hydrocalycosis and hydrocalycosis in a 22-year-old girl.

As all lesions causing back pressure give rise to stagnation of urine and its sequelae, both grade II and grade III lesions are regarded as severe lesions. Severe ureteric lesions, therefore, were present in 19 out of 75 people investigated, a prevalence of 25.3%.

The youngest child with a ureteric lesions was 3 years old, but it must be stressed that the young children usually have early lesions (grade I) only. In fact a grade III lesions was not seen below the age of 5 years. Secondly, the ureteric lesions become more common in the older children. Between the age of 2 years and 10 years, 43.7% of the children had ureteric lesions while 60.0% of the children age 11 - 20 years had ureteric lesions. It is therefore concluded that, as the ureteric lesions are more common and of more severe grades in the older children, the

bilharzial lesions must be progressive.

Bladder filling defects caused by mucosal polyps and bullae were seen in 15 I.V.P.'s (18.7%). They were common defects in children below the age of 15 years. They occurred anywhere in the bladder (figure 9 and 12).

Calcification of the bladder wall was seen in 6 persons (8.0%). In one, it extended into the distal parts of the ureters. Bladder distensibility and contractility were not interfered with by the calcification. Typical bladder calcification is illustrated in figure 17.

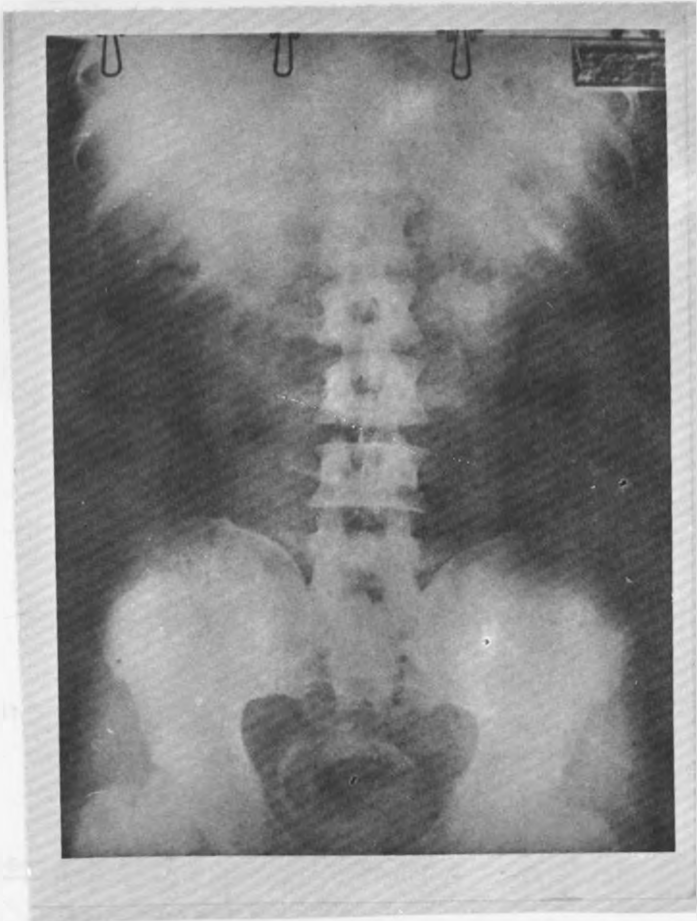


Figure 17: Bladder calcification in a 19-year-old girl.

Urinary tract calculi were present in 5 people (6.7%). Two were renal and three vesical. Figure 18 shows an asymptomatic bladder calculus.



Figure 18: A small asymptomatic bladder calculus in a 76-year-old man.

8. Cystoscopic Findings

Typical cystoscopic features of schistosomiasis haematobium were present in 72 of the 75 people, a diagnostic accuracy rate of 96%. The features are listed in Table X.

T A B L E X

DIAGNOSTIC SCHISTOSOMAL LESIONS SEEN ON CYSTOSCOPY

Bladder Lesions	Number of times seen
Visible Ova	36
Tubercles	23
Granular	34
Polyps and Bullae	19
Sandy	21
Ureteric defects	8
Leukoplakia	3

The earliest changes, seen in the younger children, consist of actual ova of schistosomes embedded in the bladder mucosa. Some of the ova were superficial to the blood vessels while others were at a deeper level. What was most remarkable was the absence of visible signs of tissue reaction around these ova. There may, however, be patches of hyperaemia or mucosal haemorrhages in association with the early changes. When hyperaemia occurs without other diagnostic features, it is regarded as a non-specific finding.

Bullae and polyps are also early features of bilharziasis. They are oedematous looking mucosal projections which may also contain visible schistosomal ova. At the bladder base they frequently obscure the ureteric orifices. Patches of haemorrhages also complicate these lesions.

Granulomatous tubercles and granular lesions are also diagnostic features schistosomiasis haematobium. The tubercles are discrete pale looking granulomata but when they occur in conglomeration they give a granular appearance and hence called

granular lesions. Both tubercles and granular lesions are very common between the age of 10 and 20 years. They are often ulcerated and bleed easily when touched or when the bladder is being emptied. Mucosal haemorrhages also occur in the granular patches.

Sandy lesions are signs of long standing bilharziasis. The youngest person with sandy patches was 16 years old. In light infection the "sands" appear as fine, shiny, intramucosal lesions. Very often they are numerous, appearing like patches of sand seen through clear lake water. Discrete tubercles are occasionally dotted in the midst of sandy patches. Mucosal desquamation occurring in flakes and mucosal fissures are commonly seen in association with the sandy lesions.

Leukoplakia was seen in three people aged 38, 45 and 50 years, all males. It is a raised patch of mucosa with loss of lustre and some phosphatic encrustation in association with other late schistosomal lesions. When gripped with biopsy forceps, leukoplakia feels firmer than the surrounding mucosa. Two of these were confirmed leukoplakia but one turned out to be squamous cell carcinoma on histopathology.

Changes in the appearance of the ureteric orifices are also signs of late bilharzia. The orifices lose the normal crescentic appearance and become "golf-hole" or may look retracted. The surrounding mucosa usually looks pale and fibrotic. A ureteric catheter, passed into the orifice, gets obstructed immediately it traverses the submucous course of the ureter, implying that fibrosis actually starts at the muscular layer of the bladder wall. The ureteric orifice itself gets stenosed very rarely.

No single case of contracted bladder was found in this series.

CHAPTER V

SURGERY OF THE COMPLICATIONS OF SCHISTOSOMIASIS

Patients and Methods

This is a review of a personal series of 94 patients with the various complications of schistosomiasis haematobium treated by surgical operations during the period 1st December, 1973 to 31st July, 1976. Most of these patients were referred from Shinyanga Regional Hospital and Kolandoto African Inland Mission Hospital where the author held regular surgical clinics. A small number were referred by Physicians from Bugando Hospital, Mwanza, after adequate basic investigations.

Shinyanga Regional Hospital received referrals from Kahama, Maswa and Bariadi District Hospitals in addition to acting as a district hospital for Shinyanga District. Every Tuesday afternoon, the author visited the hospital to see surgical out-patients and review emergency cases admitted and treated by the Medical Officers during the preceding week. Those requiring further investigations or treatment, were transferred to Mwadui Hospital. In addition, urgency or emergency surgical cases requiring specialist attention were referred directly to Mwadui by the Regional Medical Officer at any time.

Similar referral system applied to Kolandoto Hospital which served patients from the surrounding districts. It has more facilities than the Regional Hospital but the patients contribute a nominal fee for their treatment.

Table XI shows the breakdown of the total number of patients who were investigated for urological complications of schistosomiasis in Mwadui Hospital. Ureteric stenosis, urinary tract calculi, carcinoma of the bladder and contracted bladder were the complications which required surgery.

In the hospital, relevant history of urinary symptoms was recorded and basic urological investigations were done. These investigations included haemogram, urinalysis, blood urea, intravenous pyelogram and cystoscopy. Other special investigations

such as cystogram, retrograde pyelogram, endoscopic biopsy of bladder mucosa and cystometrogram were done as the circumstances demanded. Cystoscopy was done under general anaesthesia to allow endoscopic biopsy to be taken if necessary.

T A B L E X I

COMPLICATIONS OF BILHARZIA ADMITTED TO MWADUI HOSPITAL

Complications	Investigated	Operated
Ureteric Stenosis	103	36
Urinary Calculi	33	29
Carcinoma of the Bladder	38	27
Bladder Contracture	2	2
Total	176	94

RESULTS: GENERAL OBSERVATIONS

While the detailed management and results varied with the type of complication being treated, there were certain findings common to all:-

1. Age of onset All the patients, who presented with complications of bilharzia requiring surgery, were over the age of 15 years. Although radiological changes of the ureters start early in the course of the disease, it takes years before symptoms of complications develop.
2. Symptoms Haematuria, the commonest symptom of "acute bilharziasis" usually clears in late teenage even if microscopic haematuria persists. Reappearance of haematuria, turbid urine,

dysuria and frequency in later life heralds the onset of complications requiring investigations.

3. Physical signs were on the whole far from being conclusive. Special investigations, therefore, played a great role in the management of these patients, and it is to be appreciated that, without facilities which in the District Hospitals are regarded as elaborate, it would be impossible to detect these complications which cause so much morbidity and an appreciable mortality.

4. Biopsy of the late bladder lesions (sandy patches and tubercles) consistently shows both calcified and fresh ova, suggesting that without treatment the active infection persists in the older patients. It was thus necessary to give a preliminary course of Niridazole (Ambilhar) 20-30 mg/kgs body weight daily for 7 days. Seven days course is preferred for the patients with complications, as it is anticipated that they have heavy infection.

The management of the specific complications: bilharzial ureteric stenosis, urinary tract calculi, carcinoma of the bladder and contracted bladder are discussed under separate headings.

A. BILHARZIAL URETERIC STENOSIS

Stenosis of the ureter is the commonest lesion caused by schistosomiasis haematobium, as is shown in Table VIII. If it is present in isolation or is the principal cause of the illness, the patient is classified as having ureteric stenosis. A total of 103 patients having ureteric stenoses were admitted but only 36 were operated upon and will be considered here.

Symptoms

The commonest presenting complaints were loin pains and symptoms of urinary tract infection (fever, rigors, dysuria and frequency). Pain in the hypogastrium and backache were occasionally complained of (Table XII). Very few volunteer the history of haematuria in childhood.

T A B L E X I I

PRESENTING SYMPTOMS IN 36 PATIENTS

Symptoms	No. of Patients
Loin Pains	34
Dysuria	15
Fevers & Rigors	12
Frequency	5
Suprapubic Pain	5
Backache	3

Physical Findings

On physical examination 50% had tenderness of the loins and 30.6% had palpable kidneys. One patient, aged 19 had retardation of physical development, puffy face and ankle oedema but normal blood pressure.

Investigations

Microscopic pyuria was present in 32, or 89% of the urine samples. Red blood cells were seen in 14 or 39% but bilharzial ova were rarely present. Phosphatic crystals are common. Bacterial culture of the midstream urine was positive in 18 (50%) and the organisms were Escherichia Coli in 9, Proteus in 5 and streptococcus faecalis in 4 cases. Seven patients had normal urine.

Blood urea was raised above 40 mg/100 mls, in 14 patients of whom 8 had a rise exceeding 100 mg/100 mls. One patient in fact had blood urea of 375 mg/100 mls on admission. Anaemia of less than 7.4 grams was present in 9 cases and they all also had raised blood urea.

At cystoscopy, all the 36 patients were found to have sandy lesions, 14 had additional dotted tubercles. Two patients

aged 16 and 19 years had associated granular lesions with extensive mucosal haemorrhages. The granular lesions and haemorrhages cleared within 4 weeks of anti-bilharzial therapy leaving only sandy patches and tubercles. The mucous membrane often appeared pale. Deformity of the ureteric orifice was a common finding, most of them looking "golf hole". Catheterisation of these ureters is usually frustrating as even a size 3 Ch catheter gets stuck at about 1.5 cm. Some degree of stricture is regularly present in the segment of the ureter within the bladder wall even when the major stenosis is higher up.



Figure 19: I.V.P. of a 32-year-old man showing non-functioning kidney on the right side and compensatory hypertrophy on the left. The left ureter has bilharzial stenoses in the lower third but there is no proximal dilatation and pelvicalyceal system is normal. At operation he had right pyonephrosis.

The radiological changes were graded according to the effects of the stenoses on the proximal urinary tract as shown in Table IX. Non-functioning kidney (fig.19) is grade IV but the kidney that showed no function at 30 min. was followed up with an hourly picture for four hours and a final X-ray taken at 24 hours. If there was still no function, an infusion pyelogram had to be done before declaring the kidney non-functional.

Three of these patients were grade II, 28 grade III and 5 grade IV. The assessment was based on the side to be operated. Bilharziasis usually affects the ureters bilaterally although the extent and severity of the changes may not be symmetrical.

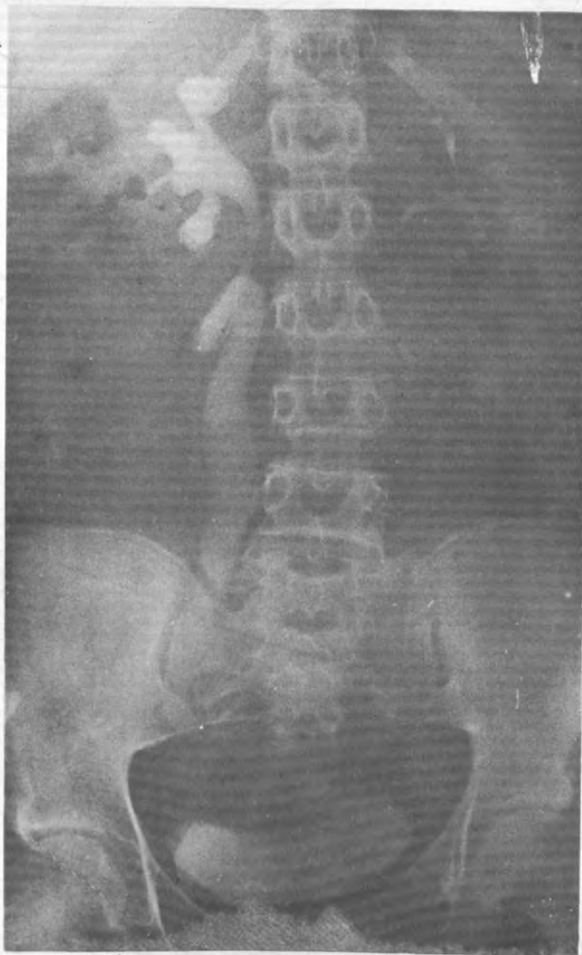


Figure 20: This I.V.P. shows gross dilatation, elongation and tortuosity of the right ureter. Note the clubbing of the calyces. Although the left kidney appears normal, its ureter was not demonstrated in all the films and catheterisation failed.

An obstructed ureter becomes dilated, hypertrophied, lengthened and tortuous rather than becoming pipestem (fig. 20 and 21).



Figure 21: Bilateral hydronephrosis with elongated tortuous ureters.

Eight patients presented in uraemia, with blood urea ranging from 110 mg/100 mls to 375 mg/100 mls. They were managed by preliminary ureterostomy in situ. The ureter is explored through a Rutherford-Morison incision and a T-tube, brought out through a separate stab incision, inserted proximal to the stricture. This technique was found useful even when the proximal end of the stricture was not visible on I.V.P. or when dye concentration was too poor to delineate the ureter. The outer end of the T-tube was connected to a closed collecting system and drainage continued until the blood urea dropped to normal.



Figure 22: This is a picture of a 19-year-old boy who presented with a blood urea of 375 mg and non-functioning kidneys on I.V.P. An emergency left ureterostomy was done and an antegrade pyelogram showed a stricture at the lower end of the left ureter. He has gross hydronephrosis.

Chemotherapy is given for any specific bacterial infection detected in the urine sample collected from the ureterostomy tube. Definitive operation is performed when the general condition of the patient has improved and adequate investigations to localise the lesions completed. (fig.22 and 23).



Figure 23: Antegrade pyelogram done at operation showing the contrast medium being injected through a scalp vein set in the same patient (fig.22). It clearly demonstrates the stricture within the wall of the bladder (arrowed).



Figure 24: The left ureter was reimplanted at a higher level and a retrograde one year later shows patent anastomosis but the hydroureter and hydronephrosis have persisted. Blood urea was 49 mg/100 mls (same boy as in figure 22).



Figure 25: This I.V.P. shows that after reimplantation despite the improvement of renal function, the structural changes that had already occurred remain irreversible.

SURGICAL MANAGEMENT

The indications for surgery were as follows:-

1. Grade IV lesions (non-functioning kidney)
2. Grade III lesions (hydronephroses of varying severities)
3. Grade II lesions with severe loin pain and/or recurrent upper urinary tract infection.

The choice of the procedure (Table XIII) was dictated by the site and extent of the lesion. Where possible, reconstruction was done with minimal excision of tissues. Excisional surgery was resorted to only when there was no alternative. The reconstructive procedures employed were ureteroneocystostomy, ureteroileocystostomy, bladder flap and meatoplasty. The indications for each procedure and the operative techniques are described separately below.

T A B L E X I I I

OPERATIVE PROCEDURES FOR BILHARZIAL URETERIC STENOSIS

Operative Procedure	No. of Patients
Re-implantation of the ureter (Ureteroneocystostomy)	12
Ileal replacement (Ureteroileocystostomy)	11
Bladder Flap	5
Nephrectomy	5
Meatoplasty	3

(1) URETERIC MEATOPLASTY

The stenosis of the lower end of the ureter as it traverses the muscular layers of the bladder was treated by meatoplasty. Although the description is "lower end of the ureter" (fig. 26), the obstruction is rarely at the ureteric orifice. It is within the muscular wall.

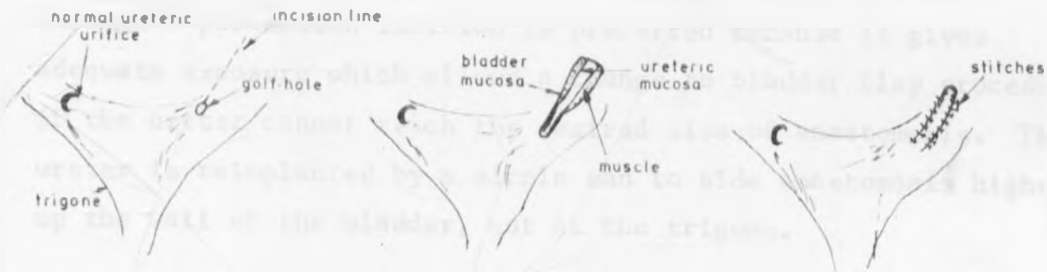


Figure 26: An I.V.P. showing bilateral stenosis of the lower end of the ureters suitable for treatment by meatoplasty.

The described procedures, bougienage and endoscopic meatotomy, were found to be impracticable because intubation of the ureter beyond the submucous portion was very rarely possible. Even if intubation were possible, bougienage would at best give rise to temporary functional benefit. Endoscopic incision of the stricture through the muscularis to the adventitial layer of the bladder may cause extravasation of urine and injury to other pelvic structures. An open meatotomy deep into the bladder muscular layer and re-epithelialisation was found more appropriate. If the stenosis is discovered to extend

Operative Technique

Cystotomy is done under general anaesthesia and the ureter is intubated with a size 4 Ch metal probe. Incision is then made over the probe with a curved No.12 blade. The incision is extended until the probe meets no more resistance thus exposing the muscular layer of the bladder as shown in figure 27. Epithelialisation is achieved by stitching the bladder mucosa to the ureteric wall thus advancing the ureteric orifice upwards and outwards.



URETERIC MEATOPLASTY

Figure 27: The operative steps are described in the text.

Results:

The success of the operation was visible immediately adequate meatotomy was done as urine spurted in jets.

Three patients had this procedure done. Their average stay in hospital was 8 days. There were no post operative complications.

After a follow up of 4 years 9 months, 5 years and 5 years 2 months, respectively, the patients are well. Vesicoureteric reflux is present in one.

(11) RE-IMPLANTATION OF THE URETER

Strictures of lower third of the ureter about 5 cm long are treated by excision and reimplantation (ureteroneocystostomy). The final decision as to whether to reimplant or not is made after excision of the stricture. If it is established that the remaining segment of the ureter is long enough to reach the desired site of implantation, the procedure is carried out.

Operative Technique

A combined transvesical and transperitoneal approach through a paramedian incision is preferred because it gives adequate exposure which allows a change to bladder flap procedure if the ureter cannot reach the desired site of anastomosis. The ureter is reimplanted by a simple end to side anastomosis higher up the wall of the bladder, not at the trigone.

A tunnel is made through the bladder wall without anti-reflux precautions and the cut end of the ureter is pulled through. Bladder mucosa and the whole thickness of ureteric wall are then anastomosed with 4/0 plain catgut transvesically. A second layer 4/0 chromic catgut anastomosis incorporating the bladder muscular wall and the ureteric adventitio-muscular layers is then sutured. Finally a few 3/0 chromic catgut stitches are placed to approximate the adventitia of both bladder and ureter. Yeates tissue drain, brought out through a stab incision, is inserted at the site of anastomosis extravesically.

Results

Ureteroneocystostomy was done on 12 patients, 3 of them bilaterally. There was no operative mortality. Leakage of urine from the site of anastomosis for more than 3 days occurred in 5

patients but all subsided spontaneously in due course.

One patient died of pyelonephritis and uraemia 19 months after operation. His renal function was very poor because of pre-existing extensive bilateral hydronephrosis. One developed re-stenosis at the site of anastomosis and had to undergo a revision operation.

The remaining 10 patients are symptom free. Seven had visico-ureteric reflux on follow up cystograms. A follow up has been carried out for periods ranging from $3\frac{1}{2}$ to $5\frac{1}{2}$ years.

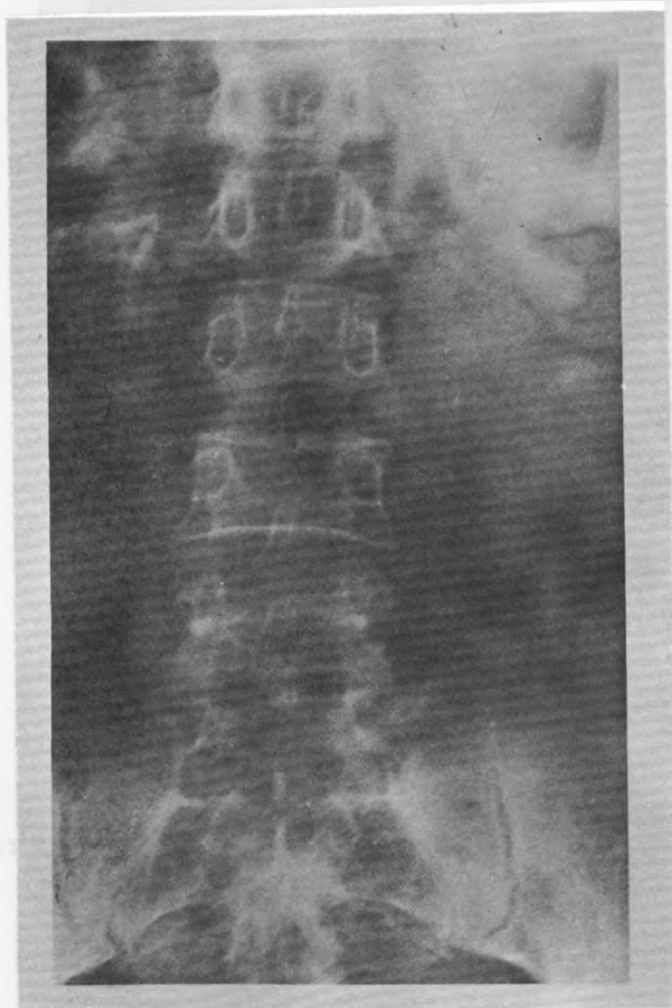


Figure 28: I.V.P. of a 47-year-old man with left hydroureter and hydronephrosis. He had a stenosis in the lower third of the left ureter (not delineated well because of poor renal function).



Figure 30: Retrograde pyelogram illustrating the ureter.

Figure 29: I.V.P. of the same patient as in Fig.28 14 months after reimplantation of the left ureter. Blood urea was normal but the structural changes due to the previous damage have persisted. Further deterioration was arrested.

RETROGRADE PYELOGRAM

When stenosis of the lower third of the ureter gives rise to a defect 100 long but reimplantation without excessive mobilisation or that is wavy fibrous around the lower end of ureter, a

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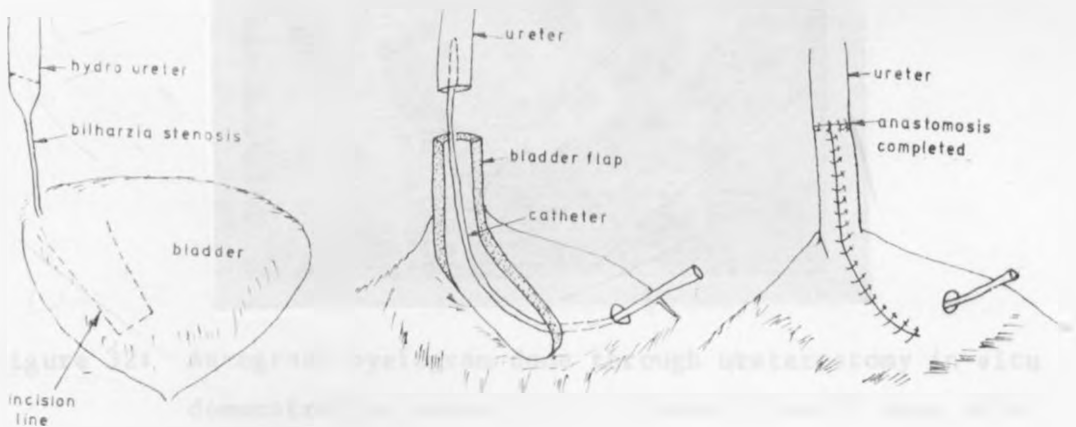
Figure 30: Retrograde pyelogram demonstrating the patency of the left ureter (fig.29) 14 months after reimplantation. Hydronephrosis is outlined.

(111) BLADDER FLAP OPERATION

When stenosis of the lower third of the ureter gives rise to a defect too long for reimplantation without excessive mobilisation or there is excess fibrosis around the lower end of ureter, a bladder flap procedure is preferred. Hypertrophy of the bladder wall resulting from outflow obstruction makes the operation more difficult while dilatation and hypertrophy of the ureteric wall facilitate it.

Operative Technique

The operation is performed extravesically through a paramedian laparotomy incision. The peritoneum over the distal course of the ureter and its extension onto the postero-superior wall of the bladder is reflected. The fibrotic length of the ureter is measured and a slightly longer flap of the bladder wall with its base towards the trigone is raised and fashioned into a tube over a nelaton catheter (fig. 31). End to end anastomosis of the tube and the ureteric stump is then done in two layers. The nelaton catheter is brought out through a stab incision on the bladder and anterior abdominal walls and kept as a splintage for 7 days. The site of anastomosis is drained with yeates tissue drain. The bladder is drained with a foley's catheter.



BLADDER FLAP OPERATION

Figure 31: Operative details are in the text.

Results:

Five patients underwent the bladder flap operation. Only one developed a post operative complication: leakage of urine from the site of anastomosis lasting 12 days. The fistula closed spontaneously.

All the 5 patients have patent anastomosis and satisfactory renal function (fig. 32). The minimum follow up is 3 years 7 months and the maximum is 5 years 8 months.

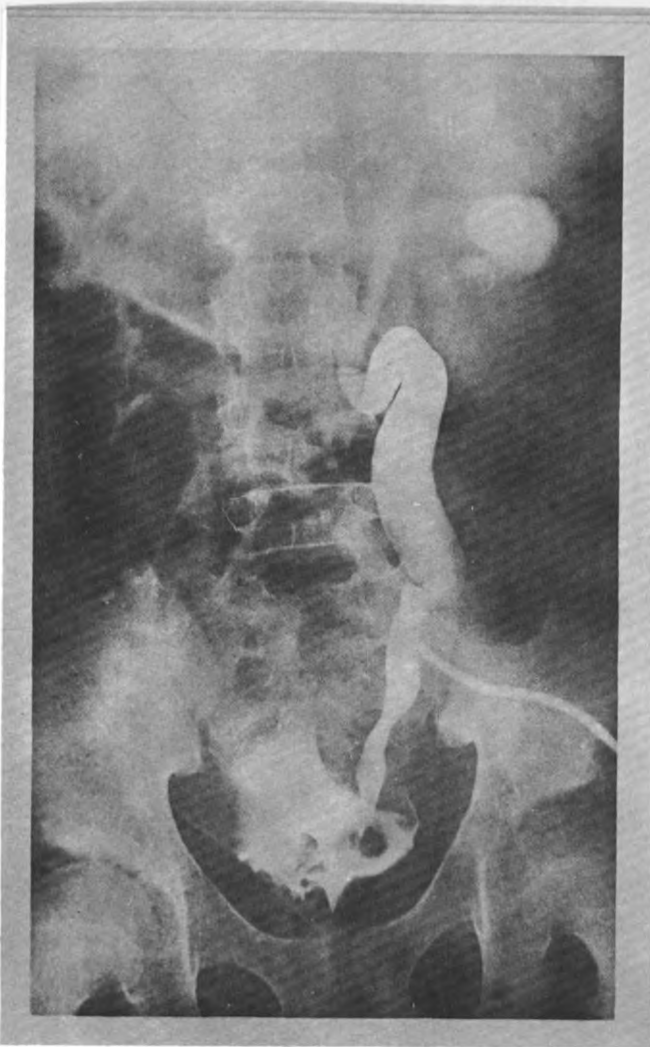


Figure 32: Antegrade pyelogram done through ureterostomy in situ demonstrating patency of a bladder flap 12 days after operation. Ureterostomy tube is removed when the anastomosis is shown to be patent.

(iv) URETEROILEOCYSTOPLASTY

Ileal replacement of the ureter is indicated when a long segment of the ureter is diseased and when the middle third or upper third of the ureter is involved. The diseased parts are easily recognised by their cord like consistency, and excised. Isoperistaltic anastomosis is preferred on the left side and antiperistaltic on the right to avoid torsion of the vascular pedicle. Anastomosis is simplified by the marked dilatation and hypertrophy of the ureter proximal to the stenosis.

Operative Technique

A paramedian incision gives a good exposure. An ileal segment close to the ileocaecal junction is isolated on its vascular pedicle (Fergusson, 1970) and the continuity of the bowel restored anterior to the isolated segment. The ureteric stump is then anastomosed end to end to the ileum. The first layer approximating the mucosa and part of the muscular layer of the ileum to all the layers of the ureteric wall is stitched with interrupted 3/0 plain catgut. The second layer of 3/0 chromic catgut is seromuscular on the bowel and musculo-adventitial on the ureteric side. It is sometimes necessary to narrow the lumen of the ileum at the site of anastomosis. Distally, a circular ostium in the posterior wall of the bladder above the trigone is excised to fit the ileum. Side to end anastomosis is then done in two layers, the first layer incorporating the whole thickness of the ileal wall and mucosa plus half of the muscular layer of the bladder using 2/0 plain catgut. The second layer seromuscular layers of the ileum and musculo-adventitial layers of the bladder are approximated with 2/0 chromic catgut. The ileum is then fixed to the posterior peritoneum using non-absorbable suture. A urethral whistle-tip catheter is inserted and the bladder closed. Ureterostomy in situ is inserted above the proximal anastomosis. A tube drain is used for draining the distal anastomosis site.

Results:

Eleven patients had ureteroileocystoplasty. There was no operative death but severe urinary infection punctuated the post-operative period in 7 patients, 4 of whom had to continue taking urinary antiseptics for 5 to 6 months. Irritating mucous secretion was present for several months in all cases.

After a follow up period of between 3 years 7 months and 5 years 4 months, the final assessment is as follows:-

1. Two patients had steady deterioration of renal function. One had no renal function after 11 months and at nephrectomy a shrunken and scarred kidney (fig.33 and 34) was found. The other developed non-functioning kidney by the 18th post-operative month and had to undergo nephrectomy.



Figure 33: I.V.P. of a 21-year-old man showing left hydronephrosis and ureteric stenoses on the right side. The left was treated by ileal segment replacement.

2. Three had revision operation to correct redundant ileal segments.
3. One is lost to follow up.
4. Five patients are well but require frequent treatment for recurrent urinary tract infection. In one the renal function is deteriorating.



Figure 34: Two years later (same patient as in fig.33) he had non-functioning on the operated side and right kidney has developed hydronephrosis.

-(v) NEPHRECTOMY

Nephrectomy is performed only when it is established that the kidney is non-functioning. Two of the 5 patients who had nephrectomy had presented with severe constitutional symptoms of fever and pain in the loins. They were anaemic, with haemoglobin of 4 g and 5.2 g respectively. E.Coli was cultured from urine specimen in both cases but blood urea was normal.

Operative Technique

The loin incision was used in all cases and the standard procedure for lumbar nephrectomy (Farquharson & Rintoul, 1972) followed. The only remarkable finding was the presence of considerable adhesions around the kidney making dissections extremely difficult. The adhesions were worst around the pelvis; definition of the pedicle was a hard task. The renal artery and veins are ligated together with two transfixion stitches in continuity. The grossly dilated kidney ruptures with ease during mobilisation. Cautious handling is, therefore, essential.

Results

One of the 5 patients had a severe wound sepsis following a rupture of a pyonephrotic kidney during dissection. Post-operative period was smooth in the rest.

All had relief of symptoms and rapid improvement of general condition after operation. An accountant who was on sick leave continuously for about two years returned to work six weeks after discharge from hospital.

The longest follow up is 4 years 9 months and the shortest 3 years 8 months. Four patients are well and have shown no radiological changes in the remaining kidney. One has developed increasing hydronephrosis but the blood urea has remained normal.

(B) URINARY TRACT CALCULI

Urinary lithiasis in association with bilharziasis is quite common in adults. Thirty three patients with calculi of the urinary tract were admitted during the period under review and 29 have been operated upon. One passed small ureteric calculi on two separate occasions on conservative measures, two are being followed up and the fourth declined surgery. All these patients were confirmed to have schistosomiasis haematobium by cystoscopy and by typical features on intravenous pyelogram. Figure 35 shows typical bilharzial stenoses of the right ureter and a staghorn calculus of the left kidney.



Figure 35: A staghorn calculus in the left kidney with non-functioning. The right side shows typical bilharzial ureteric lesions.

Clinical Features

The 29 patients, 7 females and 22 males, were aged 18 to 60 years. The older patients tended to have vesical calculi while the younger had calculi of the upper urinary tract complicating ureteric stenoses.

Clinical presentation of calculi with bilharziasis is not different from calculi of the normal urinary tract except that features of schistosomiasis are superimposed. History of haematuria in childhood is usually obtained on direct questioning. The majority of the patients present with signs and symptoms of urinary tract infection (chills, fever and increased renal or bladder pain) plus general ill health. They frequently complain of passing turbid urine. Another common way of presentation is as quiescent calculi which are discovered accidentally or when other complications occur. Appendix IIIa and IIIb illustrate such cases.

Diagnosis

A positive diagnosis is only made by demonstrating a calculus on I.V.P. or retrograde pyelogram. Retrograde pyelography, if technically possible, is also useful for demonstrating the distal obstruction responsible for the stagnation of urine that predisposes stone formation.

Management

The treatment of the calculi took priority over management of the predisposing bilharzial lesions to prevent further urinary tract damage. The distribution of the calculi in the urinary tract and the operation performed are given in Table XIV. Twelve were vesical, 10 renal and 7 ureteric stones.

(a) Renal Calculi

All patients with renal stones were advised to undergo lithotomy in view of the progressive renal changes. The standard steps for the exposure of the kidney were followed and the pelvis was approached from the back. Definition of the pelvis was difficult because of adhesions, and on occasions small calculi in the calyces were inaccessible.

T A B L E XIV

URINARY TRACT CALCULI AND OPERATIONS PERFORMED

Site	No. of Cases	Operation	
Renal	10	Pyelolithotomy	8
		Pyelonephrolithotomy	2
Ureteric	7	Ureterolithotomy	7
Vesical	12	Vesicolithotomy	9
		Litholapaxy	3

(b) Ureteric Calculi

The ureteric stones are very unlikely to pass down on conservative measures as the lower end of the ureters are usually narrowed. Therefore, if it was established that a ureteric catheter size 4 Ch could not be passed up at cystoscopy, early operation was advised. The ureter is usually markedly dilated proximal to the stone because of pre-existing stenosis.

The stenosis of the ureter was then investigated and managed separately.



Figure 36: I.V.P. showing a calculus at the lower end of the left ureter in a 25-year-old man. Ureterolithotomy was done because a stenosis at the lower end of the ureter had blocked the stone.†

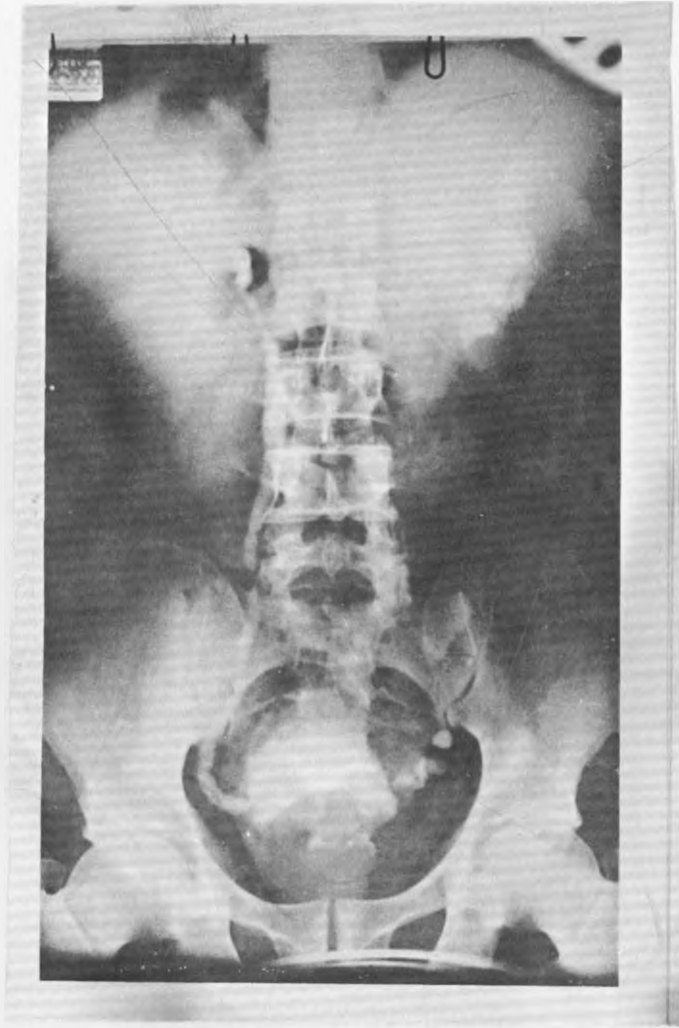


Figure 37: Multiple calculi of the left ureter. Seven calculi were removed at operation.

(c) Vesical Calculi

All the twelve patients were adults, age ranging from 35 to 71 years. The majority had cystitis. Nine patients had positive urine culture, the organisms being *E. Coli* in 8 and *E. Coli* plus *Pseudomonas pyocyanea* in one. Even the other three had sterile urine only because they had been on antibiotics before admission.

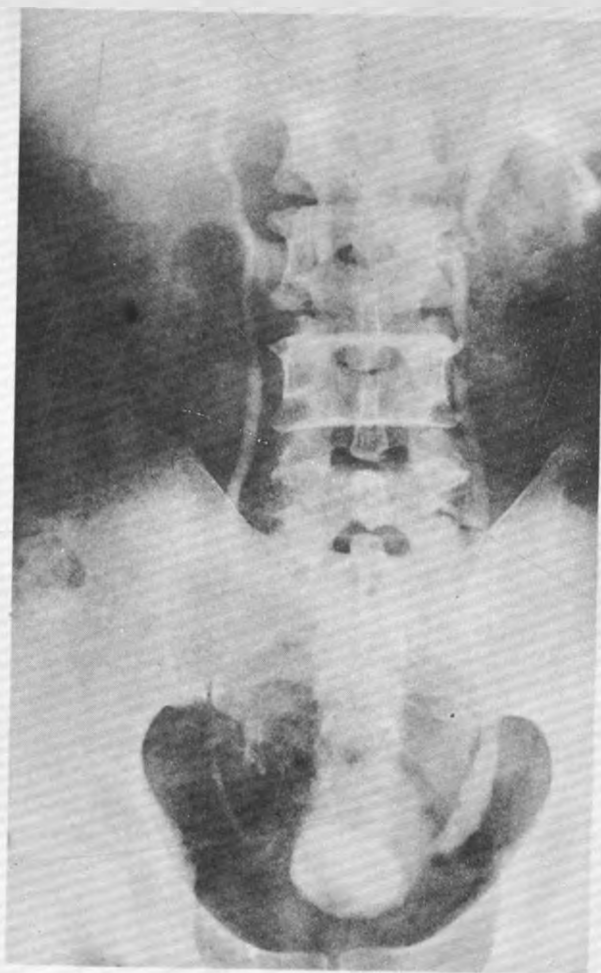


Figure 38: A bladder calculus in a 47-year-old lady.
Too large for the lithotrite.

The majority of the stones were over 5 cm and could therefore not be crushed with the lithotrite (Fig. 38 and 39). Secondly, because bilharzial lesions bleed easily during manipulations thus obscuring vision, open operation is preferred. Two of the patients who had litholapaxy had it repeated at separate operating sessions before all pieces of stones were crushed and evacuated. The rigid biopsy and foreign body forceps is a useful instrument for picking up the pieces of stones. Vesicolithotomy is the operation of choice but it is frequently followed by wound sepsis because cystitis is usually associated with bladder calculi.

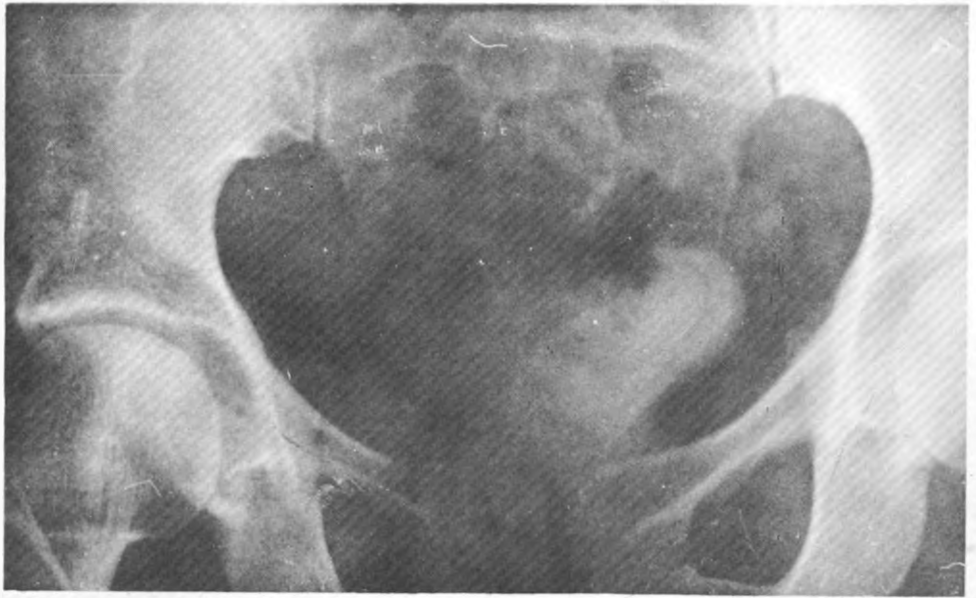


Figure 39: Laminated vesical calculus in a 55-year-old female.

Results: Twenty nine patients had the various operations for urolithiasis as shown in Table XV.

1. Post-operative wound sepsis complicated 1 pyelolithotomy and 5 vesicolithotomy.
2. Twenty two patients who have been followed up for periods ranging from 3 years 7 months to 5 years 5 months are all well and have not developed recurrence.
3. One died of complications of the other kidney 2 months after operation.
4. Six are lost to follow up.

(C) CARCINOMA OF THE BLADDER

The middle aged wasted patients complaining of haematuria or pyuria are not rare at the Dispensaries and Health Centres in Shinyanga Region but they have access to no more investigation than microscopy of the urine. Their symptoms are often temporarily ameliorated by the sulphonamides, used extensively as urinary antiseptics only to postpone the diagnosis of the real problem. Even when a clinical diagnosis of carcinoma of the bladder is made, the medical auxilliary staff are reluctant to refer them to the district hospitals because they know that no treatment will be offered to the patients, if they are at all admitted. The hospitals have no basic urological investigation facilities. There is, therefore, a considerable delay before the patients reach reference hospitals. In fact, most of these patients with bladder carcinoma were admitted via Kolandoto Hospital, not the Regional Hospital. Patients who can pay a nominal fee at a Mission Hospital can jump the chain of referral system from dispensaries, health centres to District and Regional Hospitals. Thirty eight patients were admitted and confirmed to have carcinoma of the bladder associated with bilharziasis, but only 27 were finally offered operative treatment.

Clinical Presentation

The patients were aged 30 to 56 years, mean 44.3 years and the sex ratio was 25 males to 13 females.

The common presenting symptoms (Table XV) were haematuria, pyuria, pain in the lower abdomen, dysuria, and frequency of micturition. Haematuria is not the typical painless type as 47.4% of the patients had pain in the hypogastrium and 41.1% had dysuria. An appreciable number of patients (15.8%) reach the hospital when they are already aware of the presence of a suprapubic mass. Passing small lumps made up of necrotic tumour tissue is occasionally complained of.

T A B L E XV

PRESENTING SYMPTOMS IN 38 PATIENTS WITH
CARCINOMA OF THE BLADDER

Symptoms	No. of Patients	Percentage
Haematuria	31	81.6
Pyuria	21	55.3
Hypogastric pain	18	47.4
Dysuria	16	42.1
Frequency	12	31.6
Backache	7	18.4
Passing lumps in urine	6	15.8
Mass in the hypogastrium	11	28.9

The length of history was an average of 1 year 2 months, but it must be mentioned that time sequence is not well related by the local population. There was no significant difference

in the length of history between the operated group of patients and those who were too advanced for surgery.

Nearly all the patients admitted a past history of haematuria. Pyuria is often confused with gonorrhoea; the patients actually claiming they have had gonorrhoea not responding to treatment.

The physical findings are summarised in Table XVI . Twenty one percent of the patients had no detectable abnormalities. Anaemia was present in 57.9% of the patients and bladder mass was palpable in 42.1%. Ankle oedema and ascites were common in the wasted patients.

T A B L E XVI

PHYSICAL FINDINGS IN 38 PATIENTS WITH
CARCINOMA OF THE BLADDER

Physical Sign	No. Of Patients	Percentage
No abnormality	8	21.0
Anaemia	22	57.9
Palpable mass	16	42.1
Wasting	13	34.2
Tender hypogastrium	11	29.0
Oedema	8	21.0
Ascites	7	18.4

Investigations

Anaemia was a common haematological finding, mean

haemoglobin was 6.2 g and Erythrocyte Sedimentation Rate (ESR) was raised in 57.9% of the patients.

Microscopic pyuria was seen in 31 or (81.6%) of the urine samples and red blood cells in 34 (89.5%). Twenty six patients (68.4%) had infected urine and the organisms isolated were: E.Coli 22 times, strept faecalis 14 times, Proteus 6 times and pseudomonas 5 times.

Cystoscopic examination

Cystoscopy with special attention to observing the physical characteristics of the tumours and the general appearance of the rest of the bladder mucosa, was done under general anaesthesia for each patient. The majority of the tumours appeared to have originated at the dome and lateral walls of the bladder but because they were often extensive, it was considered fruitless plotting their exact site. Instead, note was made of involvement of the ureteric orifices or the bladder neck.

The growth involved the ureteric orifices in 15 patients (39.5%) and the bladder neck in 11 patients (29.0%). Multiple tumours were seen in only 4 patients and they were all disposed close together. Sessile neoplasms with cauliflower appearance (fig.44) were seen as frequently as the ulcerated infiltrating type.

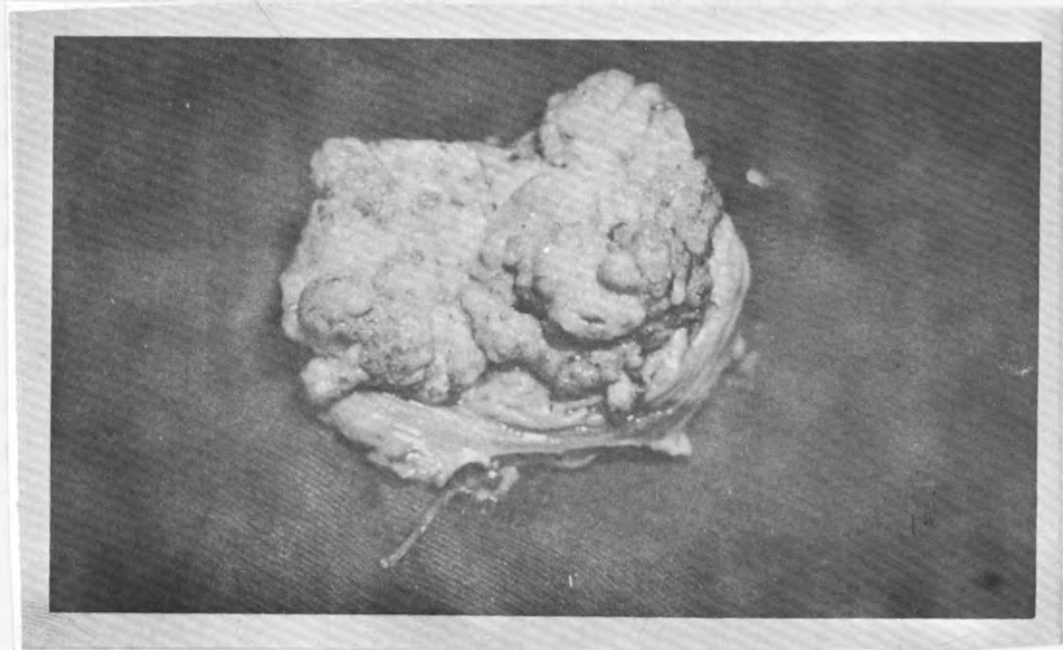


Figure 40: Partial cystectomy specimen of a T3 carcinoma. The tumour is cauliflower looking and at least 2-3 cm of normal (bilharzial) tissue excised with it all round.

The earliest neoplasm seen appeared as a raised patch of mucosa with easily bleeding fissures and phosphatic encrustation on the surface. Chronic bilharzial lesions were confirmed in all the patients.

Clinical staging

After bimanual examination, clinical staging according to International Union against cancer (U.I.C.C.) T.N.M. classification (1974) was recorded. The earlier cases in which the American staging (Jewett, 1973; Jewett and Strong, 1946, Marshall, 1952) was followed were converted to the T.N.M. method

retrospectively. It must, however, be mentioned that because the tumours were frequently large and fungating into the bladder cavity it was not always possible to take a deep biopsy which included bladder wall to confirm the pathological penetration of the bladder wall (P categories). Further, transurethral resection of the tumours was actively avoided as it is known that bilharzial carcinoma of the bladder are usually infiltrative.

The T staging (Table XVII) does not fulfil all the criteria of the U.I.C.C.(1974), as was emphasised by Wallace et al (1975).

T A B L E X V I I

CLINICAL STAGING OF 38 CASES OF CARCINOMA OF THE BLADDER

Clinical Stage	Number	Percentage
Tis	0	0
T1	1	2.6
T2	8	21.1
T3	17	44.7
T4	12	31.6

The distribution of cell type of the carcinoma and the clinical stages are shown in Table XVIII. As expected there is a marked preponderance of squamous cell carcinoma. Non-epithelial tumour was not seen.

T A B L E XVIII

DISTRIBUTION OF THE CELL TYPE AND CLINICAL STAGING OF CARCINOMA OF THE BLADDER

Clinical Stage	Squamous Cell	Adeno Carcinoma	Transition Cell Ca.	Total
Tis	-	-	-	-
T1	1	0	-	1
T2	7	1	-	8
T3	10	3	4	17
T4	9	1	2	12
Total	27	5	6	38
Percentage	71.0	13.2	15.8	100

The Lymph node (N)

Lymph node involvement was assessed at operation and 8 of the 27 operated patients were found to have enlarged lymph nodes (Table XIX). To avoid extensive dissection, only lymph nodes within the exposed field of operation were biopsied for histological assessment.

T A B L E X I X

REGIONAL LYMPH NODE ENLARGEMENT
FOUND AT OPERATION

Lymph node Stage	No. of Patients
N0	19
N1	4
N2	1
N3	2
N4	1

Radiography of the chest and any suspected sites as well as careful inspection of abdominal cavity was done to screen for distant metastasis. Three patients had distant metastases. One of these had pulmonary metastasis of squamous cell carcinoma. The second had pulmonary plus chest wall metastases while the third had liver metastases and peritoneal seedlings. The two patients with metastasis in multiple organs both had transitional cell carcinoma.

Intravenous pyelogram was found to be invaluable not only for assessing the state of the upper urinary tract but also for delineating filling defects of the bladder (fig. 41, 42, 43 and 44). In fact, there was no need for cystography since more detailed information was obtained from cystoscopy.



Figure 41: Carcinoma of the bladder arising from the dome and extending into the base thus blocking the left ureter.



Figure 42: A fungating squamous cell carcinoma arising from the bladder base but not involving the ureteric orifice.



Figure 43: Squamous cell carcinoma of the bladder arising from the right lateral wall and fungating into the cavity causing a large filling defect while the right ureteric orifice remained clear. Partial cystectomy was done.

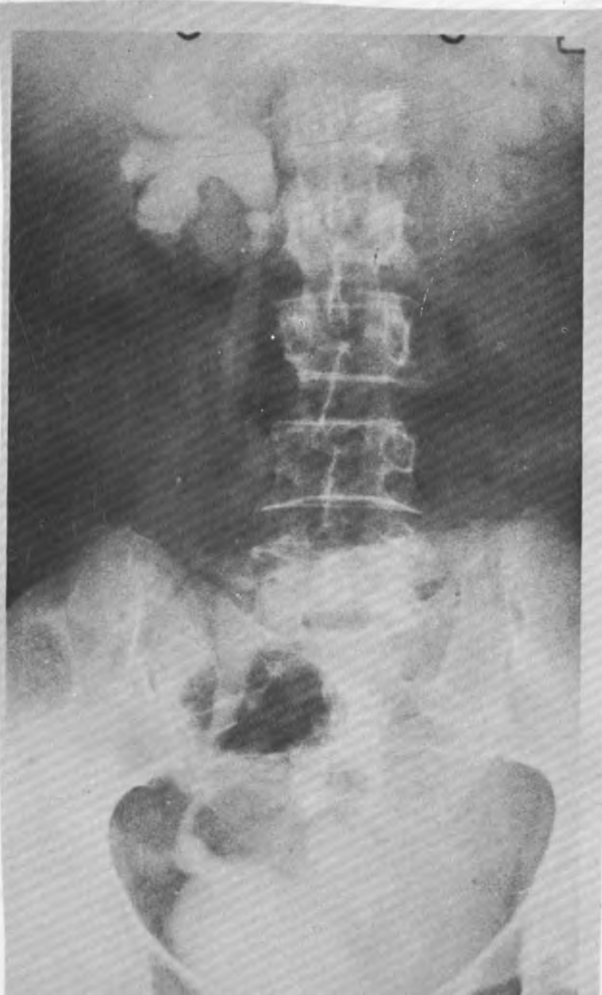


Figure 44: Transitional cell carcinoma arising from the left lateral wall partially blocking the left ureteric orifice.

TREATMENT AND RESULTS

As radiotherapy (interstitial and external irradiation) was not available, the choice of methods of treatment was limited to electrosurgery and open operation with excision of the tumour. Twenty seven patients thus had the operative procedures listed in Table XX.

T A B L E XX

ELECTIVE OPERATIONS DONE IN 27 PATIENTS
WITH CARCINOMA OF THE BLADDER

Operations	No. of Patients	Mortality
Cystodiathermy	2	0
Partial cystectomy	13	0
Total cystectomy	10	2
Ureterosigmoidostomy	2	1

(a) Transurethral surgery

Two patients were treated by cystodiathermy. One had a patch of early squamous cell carcinoma, T1 stage, and the second had a well circumscribed T2 squamous cell carcinoma. Adequate fulguration of the base of the neoplasms was achieved using coagulation diathermy current. The patients had follow up cystoscopy every two months during the first year.

Results:

The first patient is well 4 years 1 month after operation. The second had developed recurrence by the 8th month and was treated by partial cystectomy. He has not been seen for the last one year.

(b) Open operation

The indication for open surgery and resection was the ability to excise the tumour. Patients with mobile tumours up to stage T3 whose general condition was satisfactory were offered operation.

The choice of the procedure was determined by the site and size of the tumour regardless of the presence or absence of lymph node enlargement. Partial cystectomy was the procedure of choice for tumours in the dome and lateral walls of the bladder provided enough tissue to fashion out a satisfactory sized bladder remained. Contraindications to partial cystectomy were (a) tumour recurring after previous segmental resection and (b) involvement of the bladder neck or both ureteric orifices. When only one ureteric orifice was involved, resection and reimplantation was carried out (fig. 44 and 45). Dissection of the bladder base was found to be difficult because of adhesions.



Figure 45: This patient, a 50-year-old male, had a squamous cell carcinoma of the dome extending into the base and involving the left ureter. There is a calculus at the lower pole of the left kidney.



Figure 46: I.V.P. done 18 months after partial cystectomy. Left renal function improved after reimplantation of the ureter.

(i) Partial cystectomy

The standard procedures (Campbell, 1964) for partial cystectomy were followed. Paramedian incision is preferred to Pfannenstiel because it gives better exposure for both extra-peritoneal and intraperitoneal manourvres. Careful inspection of the abdominal cavity to detect regional lymph node enlargement and distal metastases is carried out. The tumour is resected in toto with 3 cm of normal bladder wall around it, and the remaining bladder closed in two layers with a whistle tip urethral catheter in situ.

Results

Thirteen elective partial cystectomy and one salvage **partial** cystectomy for a tumour recurring after fulguration were done. There was no operative death.

One patient died of distant metastasis 5 months after operation. Another one died of local recurrence 2 years after operation.

Two had to undergo salvage total cystectomy for recurrence of neoplasm. One of the two had an accidental perforation of the rectum during mobilisation of the bladder base. He developed a suprapubic fistula which gradually closed after about 7 months.

Three are lost to follow up.

The remaining six are well after a period ranging from 3 years 9 months to 5 years 9 months.

(ii) Total cystectomy

Total cystectomy and uretero-sigmoidostomy is indicated when partial cystectomy is technically impossible. The operation is a simple total cystectomy (Whitmore, 1975) carried out through a left paramedian incision following all the steps outlined by Fergusson (1970). The prostate and seminal vesicles are removed in the male. In the female a variable portion of the urethra is excised. Dissection of the pelvic lymph nodes is avoided. The ureters are then implanted into the sigmoid colon using the sub-mucosal tunnel with mucosa-to-mucosa anastomosis (Leadbetter, 1951).

Results

Ten total cystectomies were done as elective procedures. There were two operative deaths, a mortality of 20%. The post operative period was stormy in 4 who developed early urinary infection. Of the 8 survivors, 5 died before the 4th year. The remaining 3 are well but they need frequent treatment with antibiotics and urinary antiseptics for recurrent urinary infection. None has electrolyte imbalance. The 3 have remained alive for 3 years 10 months, 4 years and 5 years 2 months respectively.

(iii) Ureterosigmoidostomy

Two patients who had been prepared for total cystectomy had fixed tumours on laparotomy. One had additional metastases to the

liver and seedlings in the peritoneum. A simple dissection of the ureters and ureterosigmoidostomy was carried out.

The first one with metastasis died of uraemia three weeks after operation. The other was discharged but re-admitted five months later in uraemic coma and died.

(D) BLADDER CONTRACTURE

The contracted bladder as a complication of bilharziasis is a rare condition. The patient presents with frequency of micturition and symptoms of recurrent urinary infection as illustrated in Appendix IV. Whether or not superimposed bacterial infection is partly responsible for the formation of the contracted bladder has not been established. The contracted bilharzial bladder nearly always gives rise to vesico-ureteric reflux, unlike the tuberculous bladder which causes obstruction. On the other hand, some normal volume bilharzial bladders also develop vesico-ureteric reflux.

Management and Results

The diagnosis is confirmed when cystography demonstrates the typical contracted bladder with vesico-ureteric reflux, on one or both sides. Cystometric studies show features of diminished capacity but it is not unusual to fill the bladder to normal volume during cystoscopy under general anaesthesia. It is not associated with bladder outflow obstruction.

Indication for operation is severe frequency and recurrent urinary tract infection. Adequate follow up after completion of antibilharzial treatment is recommended before surgery.

The standard ileocystoplasty through a sub-umbilical midline incision is recommended. The ilial segment is placed as a transverse portion of the T, care being taken to make it as short as possible to avoid pooling of the urine and mucus at the ends.

Two patients have been treated by ileocystoplasty. They were both relieved of frequency but require close supervision because of frequent attacks by urinary infection. Mucus secretion has not been troublesome. They have both been followed up for over 5 years.

D I S C U S S I O N

It has been established that *Schistosoma haematobium* infection is heavy and widespread in the Sukumaland (Jordan, 1961; Forsyth, 1964; Forsyth and MacDonald, 1965; Forsyth and Bradley, 1966). In this study of unselected population of Tinde, a prevalence rate of 52.1% was found, thus confirming that, despite minor local variations, the prevalence of infection of the disease is high. The peak prevalence, 66.9%, occurred at the age of 10 years and coincided with the period of maximum egg output implying heavy infection. Infection starts very early as a 7-month-old baby had ova in his urine and by the second year of life a third of the children are already infected. Jordan (1961) also observed that the highest prevalence occurred between 6 - 12 years while in Egypt it occurred a little later at 14 years (Farooq et al. 1966).

This study further revealed that 69.3% of the positives had urological lesions detectable on I.V.P. While some of these lesions like bladder filling defects and calcification are essentially, benign, the ureteric defects occurring in 62.7% of the infected people are at the least potentially serious. In early childhood, the lesions are not associated with back pressure changes but later there is a progression from simple hydroureter to hydronephrosis with possible advance to loss of renal function. The older children not only had a higher incidence of ureteric lesions but also more advanced back pressure changes. Between 2 and 10 years, 43.7% of the children had ureteric lesions while at 11 - 20 years 60.0% had ureteric lesions.

The prevalence of severe ureteric lesions i.e. those already causing back pressure changes was 25.3%, consistent with the report by Forsyth and Bradley (1966). It is true that the advanced lesions, more common in older children, are irreversible as was observed by Forsyth and MacDonald (1966). On the other hand it is equally true that the lesions in young children showed some convincing reversal of the urological changes after treatment as reported by Lucas et al (1966). In the Ibadan series, the

bladder filling defects showed good response but only some of the ureteric lesions with back pressure changes responded. This can be explained by the fact that children with marked bladder filling defects due to granulomata and bullae usually have similar changes in the lumen of the ureter. In childhood the ureter may be obstructed by actual stricture of the ureteric wall or by the intraluminal papilomata and bullae. The latter is expected to respond well if treatment is given in time. Farid et al (1967) observed better functional and radiological improvement in the children than in adults. Therefore at a stage during the evolution of the disease the reversible lesions mature to become irreversible. It is the identification of that critical stage that is the crux of the matter.

Bhawandeon (1967) recognised "acute" bilharzial lesions which he described as granulomatous and pseudotuberculous with cellular infiltration, muscle destruction and early fibrosis. The lesions, he maintained, were proliferative and protrude into the lumen of the ureter. He also described the histology of the "chronic" lesion which involves focal segments or the entire length of a ureteric segment. The chronic lesions correlate with the sandy patches.

Cystoscopy was found to be the most useful method for the diagnosis of schistosomiasis. A diagnostic accuracy rate of 96% was obtained. Even in the absence of the typical changes, the characteristic reduction of submucous blood vessels and the pallor, are very suggestive of schistosomiasis. It is possible to estimate the stage of the disease by analysing the cystoscopic findings.

In this study, the earliest lesion observed cystoscopically consisted of discrete intramucosal ova without features of tissue reaction around them, bullae and mucosal polyps with or without complicating haemorrhages. These lesions together with inadequate filling of the bladder due to irritability resulting from "acute" Schistosoma infection are responsible for the radiological "filling defects" common in young children. The filling defects

partly disappear when the bladder is fully distended during cystoscopy under general anaesthesia. These lesions are, in fact, the precursors of Bhawandeen's acute lesions which are expected to resolve on treatment.

The endoscopic lesions that follow are the tubercles and granular lesions with frequent patches of haemorrhages. The granulomatous lesions sometimes proliferate into polyps that may give rise to filling defects of the bladder. This observation and the histopathological description by Bhawandeen indicate that they are at a stage of established chronic inflammatory process. If treated the lesions should heal with some degree of fibrosis and not with complete resolution.

The late lesions, sandy patches and discrete tubercles observed here, are associated with changes of the ureteric orifices and pallor of the trigone corresponding to Bhawandeen's chronic lesions. The description is consistent with advanced cicatrization. The late lesions are not expected to respond to chemotherapy.

The three stages of pathological lesions, early lesions, granulomatous inflammation and late fibrotic changes, represent a process of maturation which if arrested early heals by complete resolution. Patients treated at the second stage heal leaving some permanent fibrotic changes while the late stage is irreversible. The older children and adults in endemic areas are likely to be at the late stage of the disease.

Besides the host response factors, duration and weight of infection control the progress of schistosomal lesions. It was shown by Forsyth and MacDonald (1965) that children with heavy worm load develop more severe urological changes. Smith et al. (1974), in a quantitative post-mortem analysis, actually demonstrated that *Schistosoma haematobium* was directly or indirectly responsible for the death of 10% of the people with light infection and for 42.7% in those with heavy infection. It is therefore, worthwhile to treat the children just for the sake of reducing the infection load if resolution is not expected.

Evidence from histopathology now suggests that tissue damage caused by the *Schistosoma* and its ova is an immunological response. As was demonstrated by von Lichtenberg (1962) in the experimental animal, pulmonary granuloma formation is the result of gradual and continual release of antigen from the eggs. Using fluorescent antibody technique, Andrade et al (1961) showed that the parasite antigen and host antibody were present in the bilharzial lesion. The sequestration and accelerated destruction of the antigen in the granuloma was also demonstrated by fluorescent antibody technique (von Lichtenberg, 1964).

By injecting schistosome eggs into the tail veins of mice, removing the lungs at various time intervals and measuring the reaction around the ova, Warren (1972) demonstrated that granuloma formation was accelerated and augmented by sensitizing the mice with intraperitoneal injection of ova. The sensitization was shown to be specific and transferrable between histo-compatible mice using lymph node or spleen cells, not serum. These important criteria, sensitization, specificity and passive transfer, established that the schistosome egg granuloma is an immunological response. The presence of heavy egg load should, therefore, denote severe infection.

It was also demonstrating that this immune mechanism is cell mediated, involving the T-Lymphocytes and eosinophils. The exact role of the latter, besides cytotoxic activities with or without immunoglobulins, is still obscure. At least, there is a partial explanation for the association of the eosinophilia with helminthiasis.

Calcification of the bladder wall demonstrable on plain x-ray is confined within the dead ova (Buchanan and Gelfand, 1971). It does not inhibit physiological functions of the organ but indicates heavy infections. Patients with bladder calcification usually have other complications and should be thoroughly investigated.

The patients who present with severely impaired renal function and anuria need a preliminary drainage procedure. A rush

to ureteric surgery may precipitate renal failure as the other kidney is usually unhealthy too. Ghoneim (1971) tried to by pass the obstruction by introducing ureteric catheters as a diversion but failed in all occasions and recommended doing nephrostomy.

The author is of the opinion that, as most of the strictures are in the lower third of the ureter, a ureterostomy is the procedure of choice. It is a simple operation that causes less trauma to a patient who is already too ill with uraemia. Even when the stricture is in the middle third of the ureter, the Rutherford-Morison incision can be extended. The site of the stenosis is then accurately localised by introducing radio-opaque dye through the ureterostomy tube.

Antibilharzial therapy should be given and adequate follow up allowed to avoid operating on reversible lesions. Amateur "athletic surgery", as Makar (1955) would have put it, should be avoided.

Which patients should be operated upon? The following are considered to be the indications for surgery:-

1. Non functioning kidneys, to avoid development of pyonephrosis.
2. Hydronephrosis, to salvage renal function as the changes are normally progressive.
3. Ureteric lesions with back pressure changes but without hydronephrosis if there are severe symptoms or recurrent pyelonephritis is associated.

The latter is a relative indication.

Several definitive operative procedures have been described in the literature. Makar (1948) recommended endoscopic dilatation, excision and anastomosis, and reimplantation of the ureter. Sayegh (1950) also described dilatation and reimplantation but Weinberg (1970) and Ghoneim et al (1971) favoured ureteroileocystoplasty.

As introduction of a catheter or a bougie into the ureter is rarely possible, dilatation is not considered a feasible procedure. Moreover, dilatation of any tubular stenosed structure

would at best give a temporary relief.

The author has found reimplantation, bladder flap operation and ureteroileocystoplasty useful procedures for defined indications. Reimplantation is indicated for a short stenosis of the distal end of the ureter. The bladder flap operation has not been well tried for bilharzial ureters, but this work shows that it gives good results. The disadvantage common to both reimplantation and bladder flap is the resulting vesico-ureteric reflux.

Ureteroileocystoplasty is frequently followed by stormy post-operative periods and the patients need more close out-patient supervision because of recurrent urinary infection. Secondly, the bowel segment progressively becomes redundant and renal function deteriorates. It should, therefore, be done only when an operation involving complete restoration of urethelium is impossible. It is indicated in long segment strictures and strictures of the upper two third of the ureter.

A new operation for stenosis of the intramural part of the ureter, meatoplasty, is described here. Endoscopic meatotomy, Honey (1968) recommended as the treatment of choice for such stenoses was not found practicable for the following reasons.

- (a) As the obstruction is not at the ureteric orifice but is within the muscular layer, it is impossible to get adequate release of the stenosis by endoscopic meatotomy.
- (b) Deep incision without adequate vision may lead to injury to perivesicular structures or extravasation of urine.
- (c) Leaving raw surfaces after incision is followed by bridging and restenosis.

Meatoplasty is carried out under open vision. The incision is carried until the obstruction is completely released. If the stenosis extends beyond the muscular layer, the operation is easily changed to reimplantation. It is a simple procedure with very good follow up results.

As bilharzial tissues do not take well to excessive handling (Sayegh, 1950) the operative procedures should be as simple as possible. Excisional surgery is avoided where reconstructive procedures are possible. Nephrectomy is only done for non-functioning kidneys and hydronephrosis with symptoms, not all hydronephrosis as reported by Lowenthal and Roberts (1934).

It is advisable to site ureterostomy *in situ* (Walsh, 1967) proximal to the anastomosis for 10 - 12 days as it is known that healing of bilharzial tissues is normally delayed (Bland and Gelfand, 1970).

The incidence of urinary tract calculi in the sample investigated was 6.7% and confirms the clinical impression that calculus is a common disease in bilharzia endemic areas. Forsyth and Bradley (1966) reported 7% incidence at Bukumbi.

The significance of this study is not only because it corrects previous misconceptions that "immunity from calculi would appear to be one of the privileges of the negro race" carried by David Livingstone (1857) but it also elucidates the severity of the urinary tract damage caused by calculi. It is to be noted that while bladder calculi are common among the elderly, renal and ureteric stones complicating ureteric stenoses are frequently seen in young people. Singh et al (1973) drew attention to the effects of asymptomatic stones in the kidney. They cause severe hydronephrotic changes before being discovered.

It is recommended that renal and ureteric calculi be removed early to save further renal damage. The ureteric stone, even a small one, is unlikely to pass through the distal course of the ureter. Bladder calculi are often large and are associated with urinary tract infection. Adequate treatment for the cultured organism should, therefore, be given before cystolithotomy.

The association between bilharzial and carcinoma of the bladder has for long been appreciated (Ferguson, 1911). Even though the causal relationship has not yet been established, bilharzia is incriminated in endemic areas for the following reasons.

- (a) The ova are always present in the biopsy specimen.
- (b) The cell type of the neoplasm is more of squamous and adenocarcinoma than the typical transitional cell seen elsewhere.
- (c) The age of onset is lower than the age of patients with carcinoma of the bladder in non-endemic areas.

A different situation arises in Uganda where squamous cell carcinoma is also common in association with stricture of the urethra (Anthony, 1974).

Vesical leukoplakia, observed to develop into carcinoma (O'Flynn and Mallaney, 1974), is a common finding in the bilharzial bladder. Such lesions need adequate endoscopic follow up. The incidence of carcinoma of the bladder itself is difficult to estimate in a small series like this but the fact that one out of the 75 sample of people cystoscoped had carcinoma indicates it is a common condition.

Because of the considerable delay between the onset of symptoms and admission to the District Hospital, many patients become moribund with fixed bladder masses and generalised effects of neoplasm before being investigated. The 38 patients who finally reached the reference centre thus form a selected group with an average length of history of 1 year 2 months.

The clinical presentation of carcinoma of the bladder is often marred by the symptoms of chronic bilharziasis. Haematuria is not heavy except in terminal stages and is usually unalarming because phosphatic crystals make urine turbid. Super-added bacterial cystitis also gives rise to confusing symptoms and signs. Cystoscopy and endoscopic biopsy are therefore essential for early diagnosis. Even if histopathological categories and grading are not available, management is planned on the knowledge of histological typing well standardised by Mostofi et al (1973).

The methods employed for the treatment of the patients in this study are not necessarily the standard as reviewed by Hendry and Bloom (1976) but are methods considered to be the most

practical under the prevailing circumstances. The choice of treatments was limited to surgery as radiotherapy was not available nearby and it was not easy to refer a patient 600 miles away to Dar-es-Salaam.

Every patient who had a mobile tumour (stage T1, T2 or T3) was offered surgery. The choice of procedures was confined to partial cystectomy, total cystectomy and fulguration. The latter had limited application since early pre-invasive neoplasms were rarely seen. Fulguration is useful for the circumscribed lesions which are slightly raised above the rest of the mucosa and is done at the time of biopsy. If the histology shows muscular invasion, nothing is lost by doing a partial cystectomy. Transurethral resection was avoided because it was considered that adequate resection of these sessile infiltrating tumours was not possible.

Partial cystectomy is the procedure of choice because it is simple, it leads to low morbidity and mortality rates (Resnick and O'Connor, 1973) and requires no urinary diversion. Pryor (1973) maintained that the factors responsible for the survival of the patient are the nature and stage of the disease, not the treatment regimes. The fear that partial cystectomy is a compromise operation is not real if the tumour is excised with a good margin of normal tissue. Multiple tumours only formed 10.5% of this series and the satellite growths were close to the tumours. If the bilharzial worm and its live ova are treated, constant mucosal "irritation" with the carcinogen should partly be relieved. Recurrence that may appear in areas where pre-malignant changes had occurred are noticed at endoscopic surveillance. So far only two cases of recurrence have occurred.

Total cystectomy is effective as a cancer ablative procedure but it has two serious drawbacks viz: a high mortality and complications of urinary diversion. A mortality of 20% though comparable with other series (Khafagy et al, 1975) is high. Ureterosigmoidostomy was used as a standard diversion method. All the survivors get frequent fevers attributable to pyelonephritis

but no electrolyte imbalance has been noticed. The risk of renal infection, electrolyte imbalance and deterioration of renal function, noticed in long term follow up of ureterocolic anastomosis (Jacob, 1967), is expected to be more serious in bilharzial patients who already have renal impairment caused by ureteric stenosis. The incidence of these complications are about the same in ureterosigmoidostomy and ileal conduit (Zincke and Seguru, 1965). Furthermore, the latter has the additional disadvantage of requiring urine collecting appliance which are just unobtainable in rural areas. Ileocaecal conduit (Zinman and Libertino, 1975), though an improvement on the ileal, still needs appliances. Rectal bladder would be socially unacceptable because of the introduction of "faecal fistula" (Handley, 1967). Ureterosigmoidostomy, therefore, offers the most practical diversion method when total cystectomy has to be done because partial cystectomy is contraindicated.

There have been some favourable recent reports about the use of chemotherapy for palliation in carcinoma of the bladder. Hall et al. (1974) observed good response in 26%, though side effects interrupted treatment in more than half. Cyclophosphamide was found to be useful by Fox (1965). Merrin et al. (1975) recommended cyclophosphamide and adriamycin as adjuvant chemotherapy. These reports even if they apply more to transitional cell carcinoma, give hope that chemotherapy as adjuvant to surgery could be helpful to the patients with late bilharzial carcinomas.

Since Helmstein (1966) introduced the hydrostatic pressure therapy, several workers have confirmed his findings. England et al. (1973) found it reliable for pedunculated tumours and about half of T4 tumours had worthwhile palliation. Glashow (1975) reported that the method was useful for the treatment of T1 and T2 tumours and for a palliation in advanced growths. Helmstein (1972), in fact, recommended this method which produces tumour necrosis by reducing the blood circulation for "highly malignant, for advanced tumours not accessible for irradiation or surgery". This method could very usefully be evaluated in the

many bilharzial bladder carcinomas that go without treatment.

The **contracted** bladder needs further assessment. The symptoms and cystometric features are consistent with either reduced bladder capacity or reduced threshold resulting from inflammatory changes. The fact that bladder capacity is frequently normal at cystoscopy weighs in favour of the latter. Pressure studies and longer follow up on conservative treatment are recommended.

C O N C L U S I O N S

The overall prevalence of schistosomiasis haematotibium in 3687 unselected residents of Tinde was 52.1%. Infection starts early and reaches a maximum prevalence of 66.9% at the age of 10 years. A clinical study of the random sample of the positives showed that 69.3% had radiological lesions: ureteric lesions, bladder filling defects, bladder calcification and calculi. It was noted that the ureteric lesions, occurring in 62.7% of the positives, were the most important lesions of the urinary tract. Severe ureteric lesions, causing back pressure changes, were present in 25.3%.

Intravenous pyelography was found to be the most useful single investigation for assessing the effects of schistosomiasis on the urinary tract. Cystoscopy is invaluable for observing and staging the mucosal lesions for the purpose of predicting response to chemotherapy. Early lesions are expected to respond well while late lesions are irreversible. Endoscopic biopsy is useful in the surveillance for malignant and premalignant changes. Bacterial infections are not associated with uncomplicated schistosomiasis. Blood urea and serum creatinine are unhelpful except in late cases. Eosinophilia was present in more than half of the people.

Ureteric stenoses are amenable to surgery but only the lesions causing obstructive changes should be operated. Repair of the stenoses arrests further structural damage to the proximal urinary tract but the changes that had already occurred remain unaltered. The operative procedures should be reconstructive as the opposite sides are usually involved and may deteriorate with time. Nephrectomy should only be done for established non-functioning kidneys and for hydronephrosis with symptoms of infection or severe pain not relieved by reconstructive procedures.

Lithotomy for renal and ureteric calculi to salvage renal function takes priority over the management of the ureteric stenoses. The latter are then assessed on their own merits. The majority of the bladder calculi are large and require suprapubic vesico-lithotomy.

All non-fixed carcinomas of the bladder are best treated by partial cystectomy but when they involve both ureteric orifices or the bladder neck, total cystectomy with uretero-sigmoidostomy is the **best** alternative. It is suggested that adjuvant chemotherapy and Helmstein's hydrostatic pressure for the treatment of advanced fixed tumours may improve the management.

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APPENDIX II

UROLOGICAL COMPLICATIONS OF S. HAEMATOBIMUM

IN-PATIENT RECORDS

Name:

Survey No.

Hospital No.:

Age:

Sex:

Ward:

Village:

Symptoms: Present Absent Uncertain

Specific complaints:
.....
.....

Duration:

Physical Examination

General condition:

B.P.: Liver:

Left Kidney:

Right Kidney:

Bladder:

APPENDIX II

Investigations

1. Stool S. Mansoni Positive Negative

2. Haemogram HB W.B.C.
P.C.V. E.S.R.

3. Urine a. Sugar: Positive Trace Negative

b. Albumen: Positive Trace Negative

c. Culture (i) 10^5 or more colonies/ml

(ii) Less than 10^5 colonies/ml

(iii) Sterile

Organism Isolated :
.....
.....

4. Blood Urea mg/100 ml Serum Creatinine mg/100ml....
Creatinine clearance

APPENDIX II

5. I.V.P. Findings Normal Abnormal Inconclusive

Bladder calcification: Present Absent

Calculi: Present Absent Doubtful

Site: Kidney Ureter Bladder

Ureteric deformity: Unilateral Bilateral

Non-functioning Kidney: Left Right Both

Bladder Filling defect: Present Absent Doubtful

Others:

6. Cystoscopy

Bladder capacity mls.

Lesions: Hyperaemia Granular

Tubercles Sandy

Pallor Polyps

APPENDIX II

Ureteric orifice: Normal

L	R
---	---

Pinhole

L	R
---	---

Retracted

L	R
---	---

Not Visible

L	R
---	---

Leukoplakia

--

Others:

Biopsy report:

.....

.....

Summary of treatment:

.....

.....

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APPENDIX III

CASES OF "QUIESENT" CALCULI

(a) N.C. male aged 26 years was admitted with the history of haematuria after falling off a bicycle and knocking his right flank. He denied previous history of loin pains or recurrent fever. He had bruises on his right loin and total haematuria was confirmed. Intravenous pyelogram demonstrated a stone in the right renal pelvis, and in the middle plus lower calyces with marked hydronephrosis (fig. 47 and 48). At cystoscopy there were sandy patches and tubercles. Catheterisation of the right ureter was attempted but the ureteric catheter was obstructed at 1 cm.

He was treated conservatively until haematuria cleared. When surgery was advised, he declined on the ground that his condition was not a bother to him.

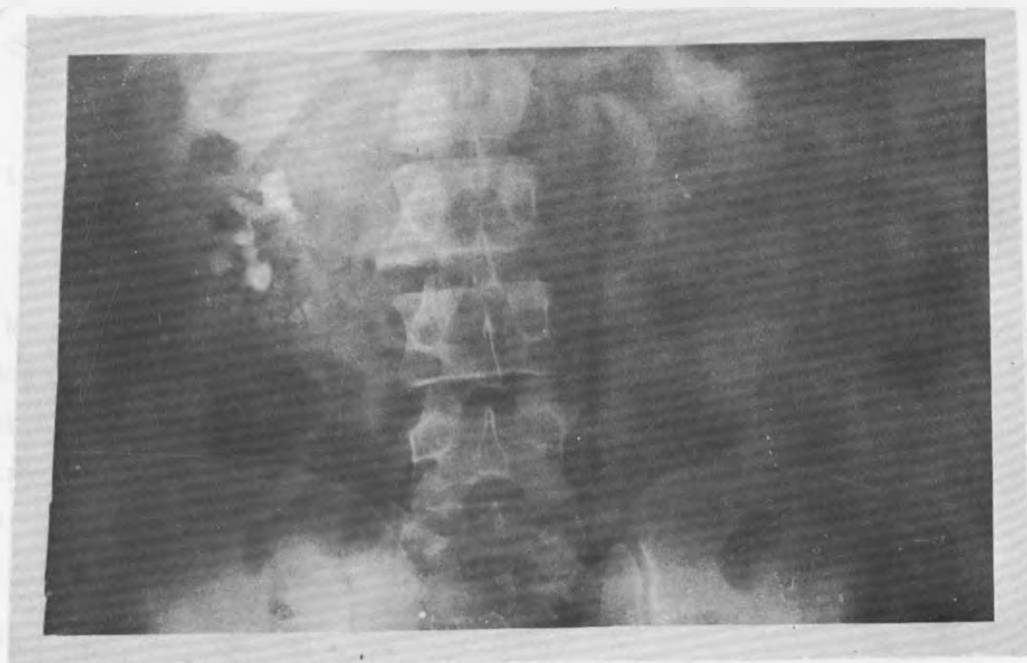


Figure 47: "Asymptomatic" right renal calculi. The calculi were discovered during investigations for renal trauma.

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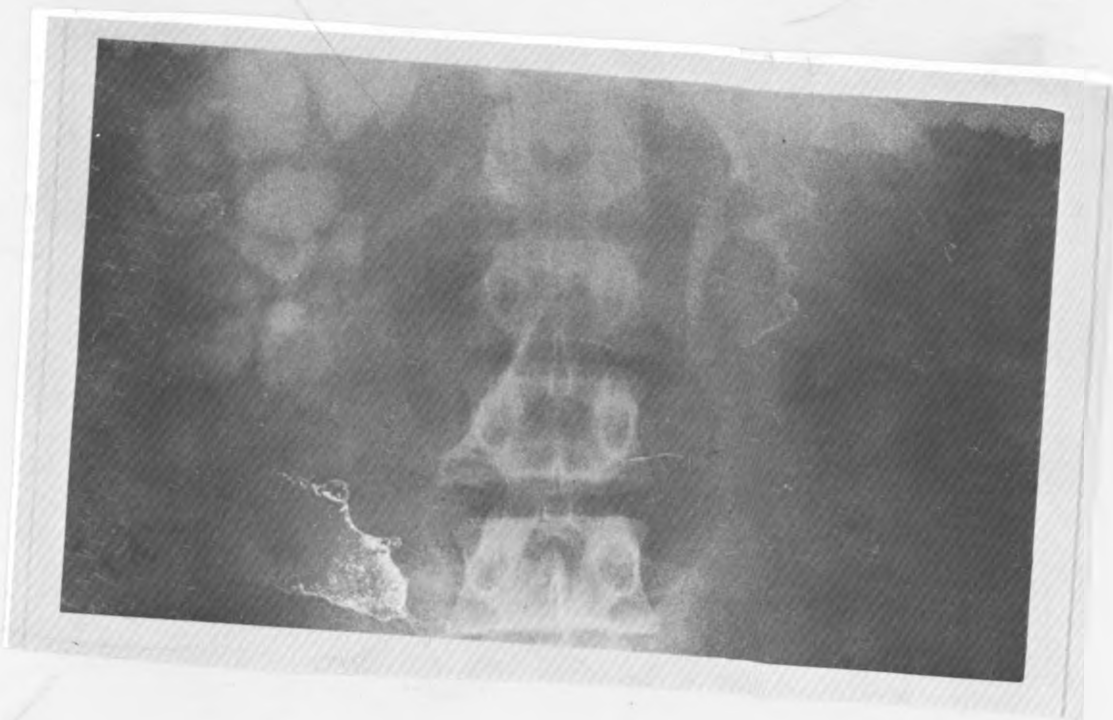


Figure 48: I.V.P. demonstrating hydrocalycosis caused by the "asymptomatic" calculi.

(b) H.C., female aged 18 years, presented at Kolandoto Hospital with 14 pieces of faceted calculi in an envelope. The stones were discharged through a sinus just above the right iliac crest. A little pus, but not urine, was still draining from the sinus. Her general condition was good.

Blood urea and haemoglobin were normal. Urine culture was sterile. Intravenous pyelogram showed a non-functioning right kidney with a stone in the pelvis plus multiple small calculi in the lower calyces (fig. 49 and 50).

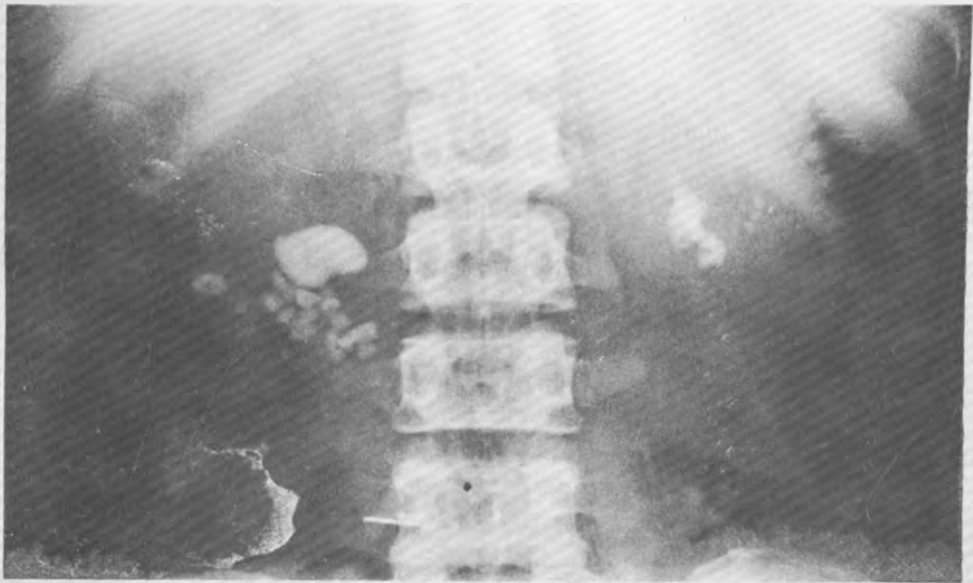


Figure 49: The young lady was discharging stones through a sinus above right iliac crest. Note there is one stone en route. The left side also has calculi.

One calculus was already out of the renal tissue on its way to the sinus. The other kidney, unfortunately, also had calculi in the lower calyceal group causing hydrocalycosis and a few small ones in the middle group. Schistosomiasis was confirmed at cystoscopy. Catheterisation of the ureters failed.

Right pyelolithotomy was done but the renal function could not be restored. The patient was sent home for convalescent but before re-admission for operation on the left side, she developed a left ureteric stone and died in uraemia at another hospital.

APPENDIX III



Figure 50: I.V.P. of the same patient (fig. 49) showing no renal function on the right and hydrocalycosis of left lower group.

These two cases demonstrate that "quiescent" calculi occur in association with bilharzia and that the renal damage caused is progressive and severe.

APPENDIX IV

CASES OF BLADDER CONTRACTURE

The following cases illustrate the clinical presentation of the patients with bilharzial "bladder contracture".

(a) N.D. male aged 34 presented with 2 years history of frequency of micturition, 4 - 6 times at night and many times during the day. He had haematuria which cleared without treatment during childhood. There was no significant finding on physical examination. Blood urea was 28 mg/100 mls. Urine was sterile on culture. At cystoscopy under general anaesthesia the bladder capacity was 400 mls and extensive sandy lesions and occasional bilharzial tubercles were present. There was no significant residual urine. Cystometrogram showed a bladder capacity of 250 mls. I.V.P. showed bilateral ureteric stenoses with normal renal calyces.

He was given a course of Ambilhar for 7 days and ileo-cystoplasty was performed 2 months later. He had an uneventful post-operative recovery but kept on developing recurrent cystitis during the following three months. The frequency of micturition was relieved.

(b) K.M. a male aged 40 years, complained of severe dysuria, frequency, 5 - 6 times at night and about 9 times during the day, and occasional pyuria for 6 months. He had untreated bilharzia in childhood. His general condition was good and there was no suprapubic tenderness. Urine examination showed viable *Schistosoma haematobium* ova and *E. Coli* was cultured. He had a blood urea of 30 mg/100 mls. Bladder capacity on cystometrography was 225 mls. At cystoscopy the bladder capacity was 450 mls and sandy lesions were present. I.V.P. showed bilateral ureteric stenoses with marked proximal dilatation and clubbing of the calyces on the left side.

The urinary infection was treated with ampicillin and the bilharzia with ambilhar. A month later he was re-admitted and ileocystoplasty was done. He recovered well and the symptoms of frequency disappeared. He still develops urinary infection from time to time.