

Thesis presented for the Degree of  
DOCTOR OF MEDICINE.

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" A Clinical Study of Schistosomiasis  
in the European Resident in Southern Rhodesia  
with particular reference to New Methods of  
Diagnosis and Treatment".

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A Clinical Study of Schistosomiasis in the European Resident in S. Rhodesia with particular reference to New Methods of Diagnosis and Treatment.

INTRODUCTION.

The author has been engaged in the general practice of medicine in S. Rhodesia since 1937, over a period of 9 years. In Bulawayo and at Salisbury, the capital city.

The author has had ample opportunities to study the Rhodesian child, adolescent and adult in health and sickness and has been impressed by the high incidence of Bilharziasis in the country through all classes of the community, both European and native, child and adult.

The present thesis deals with new methods of diagnosis and treatment (Preventive and Curative) of the disease in so far as the European subject is concerned. Mention, however, must be made that Schistosomiasis is not a disease peculiar to the European. The European and the native inhabitant are equally susceptible to its ravages and since the life of one community is so dependent upon that of the other, the two are faced with common problems.



Historical Survey of Schistosomiasis, Parasitology,  
and Intermediate Hosts of the Disease.

This aspect of Schistosomiasis is so familiar in medical literature that it is only necessary to give a brief summary of general knowledge with emphasis on those aspects affecting Rhodesia.

Bilharz, in 1851, has the credit of being the first to describe the species of blood flukes bearing his name - Schistosomidae. He described the habitat of the flukes - the adult inhabit the portal system and its tributaries, the female depositing her ova in the walls of certain hollow viscera where they reach the exterior of the human body by way of the urine and faeces excreted.

Modern work in the life cycle of the Schistosome has already been defined by authors, e.g. Hamilton-Fairley, and reference to one of these works should suffice.

The Schistosomidae comprises:

1. *Schistosoma haematobium* - causing vesical Schistosomiasis, the characteristic ova having a terminal spine.
2. *Schistosoma mansoni* - causing intestinal Schistosomiasis, the characteristic ova having a lateral spine.
3. *Schistosoma Japonicum*/

3. *Schistosoma Japonicum* - causing a similar symptomatology to the *S. mansoni* and a predilection for the alimentary tract.
4. *Schistosoma Intercalatum* - described by Fischer (1934) in the Belgian Congo. A comparatively new Schistosome. *S. intercalatum* has ova similar to *S. haematobium* but the ova are deposited in the bowel and not in the bladder.

The Intermediate Hosts.

Miyairi and Suzuki (1914 ?) in Japan and Leiper (1913 ?) in Egypt found the intermediate host to be a fresh water snail. It becomes invaded by the freely swimming miracidium liberated from the *Schistosoma* ova in contact with water.

The Intermediate Hosts vary in different countries, e.g. *Bulinus contortus* in Egypt.

*Physopsis Africans-Krauss* (1848) in Natal.

*Planorbis mitidjensi* in Portugal.

In S. Rhodesia are found the species -

*Physopsis Globosa* Mordet (1866) which is the habitat of the developing *S. haematobium*.

*Planorbis Pfeifferi* Krauss (1848), which is the habitat of the developing *S. mansoni*.

Man may occasionally be infested by certain animal specimens - *Schistosoma bovis* (a veterinary disease of sheep/

of sheep and cattle), and *Schistosoma matthee* (found in baboons in S. Rhodesia). Blackie (1932) stated that although no natural infections were found in animals, *S. mansoni* could be introduced in *Circopithicus* artificially and persisted for six months. That *S. matthee*, with Intermediate Host *Physopsis Globosa* was not a negligible parasite of man in S. Rhodesia, and with development of stock farming was likely to become important. Subsequent research on this aspect of the disease in S. Rhodesia has not revealed any marked increase in this species (*S. matthee*).

Cawston (1940) described the characters of the fresh water molluscs found in S. Rhodesia and the Union of S. Africa. He maintained that the common species in these countries was popularly known as *Physopsis Africana* Krauss.

Gopsill (1931) in his report from Nyasaland, a near neighbouring state to S. Rhodesia stated that *Physopsis Africana* Krauss (host S.H.) and *Linnaca Lomenti* (host S.M.) were found in the North Nyasa District, but that there were no *Planorbis Pfeifferi*.

The Disease and its relationship to S. Rhodesia and  
the other African States.

Schistosomiasis, both vesical and intestinal, is an endemic disease affecting the greater part of the African continent, particularly Egypt, the Sudan, and other areas of North and West Africa. The whole of Central Africa, East and West Africa, Northern and Southern Rhodesia and certain parts of the Union of S. Africa, e.g. the Transvaal and Natal.

The Historical picture is interesting.

The disease is said to have originated in the Nile valley, where it has been endemic for thousands of years. Ruffer (1914) found ova in the renal pelvis of a mummy of the 20th dynasty 1250-1000 B.C.

In S. Rhodesia Schistosomiasis was mainly sporadic and confined to ill-defined areas (native reserves particularly) until 1918. Since then it has become widely endemic throughout the territory and hyper-endemic in well-defined areas.

Theories to explain the entry of the disease to the colony and its rapid advance and distribution since 1918 have been described. The origin of the disease in S. Rhodesia is alluded to in Gale's historical work "One Man's Vision". In S. Rhodesia, ancient gold mine/



gold mine workings abound in the gold bearing areas, and ruins of an ancient civilisation exist (Zimbabwe, Fort Victoria District, and Khama ruins Bulawayo District). Their origin dates back to the time of the Queen of Sheba. Her subjects in Egypt penetrated south in the African continent in quest of gold and other riches for the Queen. Arab slaves followed recognized caravan routes to reach the environs of the African territory now known as S. Rhodesia. The dissemination of Schistosomiasis followed along these routes and spread to the southern parts of the African continent. From that era until the occupation of S. Rhodesia in 1887 by Rhodes and the granting of a charter to the Brit. South African Coy. the disease remained dormant. The advent of European civilisation with its resulting development of the colony and establishment of an increasing European population stimulated the dormant Schistosomes to activity.

The rapid spread of the disease since 1918 has been closely related to these factors, and to the disturbance of a large, indigenous native population. The male native has become an integral part of the commerce of the country. He has likewise been absorbed into domestic service. The result has been a steady/

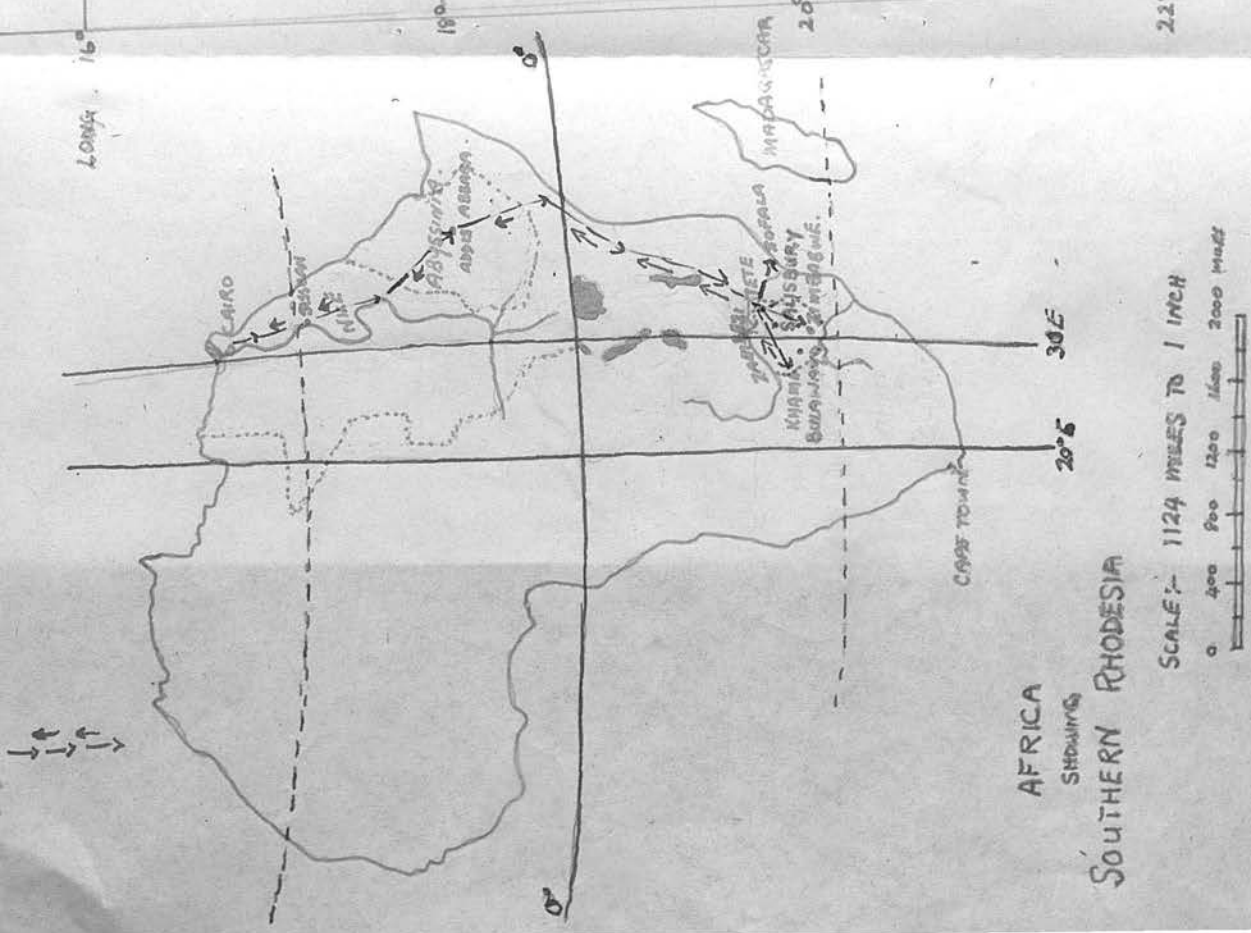
a steady flow of natives to and from their native reserves to the cities, towns, mines and farms to obtain work. Besides this, native labour has been recruited from neighbouring territories, particularly Nyasaland and N. Rhodesia by native labour bureaus for work not only in S. Rhodesia, but in the gold fields of S. Africa. The dissemination of the disease by pollution of the rivers of the territory has resulted from this policy.

The disease has, therefore, become a real menace to the inhabitants, both European and native of S.

Rhodesia and other parts of Central and South Africa.

Gelfand (1942) summarises the situation well -

"Bilharzia is the commonest disease next to malaria in S. Rhodesia. It causes many deaths, predisposes to avitaminosis, tuberculosis, pneumonia, and many other diseases; apart from its medical importance it is responsible for severe economic loss".



QUO  
 REFERENCES  
 TO



SOUTHERN RHODESIA  
 20 0 20 40 60 80 100 120  
 MILES

320  
 300  
 280  
 260

INYANGA  
 ROAD ALIGNED AT 7000  
 RAILWAYS  
 WEST NICHOLSON  
 SHIRAZI  
 AMBAKAZI  
 ZIMBABWE



A General Description of the Geography and Topography of the Colony. The Population and information regarding the Medical and other Services and conditions that obtain in Southern Rhodesia.

S. Rhodesia lies between the Equator and the Tropic of Capricorn, bounded by the Zambesi river to the North, the Limpopo river to the South, the Bechuanaland Protectorate to the West, and Portuguese East Africa to the East. In area, 144,000 square miles in extent, being three times the size of England. For the most part it is a high plateau, being part of the "high veld" that huge plateau which forms most of the southern part of Africa. The high veld is covered with coarse grassland and low bush, vegetation is luxuriant in the wet season only, and trees of indigenous type and thorn bush cover the ground.

The Altitude - 4-5000 feet above sea level; varying from 8000' in the Eastern Districts, bordering on Portuguese East Africa to 700' above sea level in the south where the Limpopo river leaves the colony to the South East.

The Seasons - There are three seasons in the year.

1. Dry - May to August with low mean temperature, 40-50° F., corresponding to the English winter.
2. Hot/



2. Hot - August to November with high mean temperature, 90-100° F., in the shade and low humidity.

3. Wet - November to April.

The rainfall varies from 40" to 60" in the Eastern Districts to 15" to 20" in the Western boundaries. The rivers in the wet season are in flood and a cleansing effect results from the removal of refuse and decayed vegetable matter from the encatchment areas and river beds. The river levels fall rapidly at the close of the wet season and by June the water levels have reached the dry weather low. The mean temperature for the year is 70-80° Fahrenheit. The Climate - Temperate and sub-tropical and throughout the year the days are almost of equal length; there is no twilight. The sun is always high at mid-day the whole year round and the difference in length of the days between January and June is no more than 30-60 mins.

The Population - No Government census has been taken for five years but the Government Statistical Department figures (approximate) in 1945 were:-  
European - 80,500,  
distribution in/

distribution in two large cities - Salisbury the administrative capital (18,500) and Bulawayo the commercial centre (18,000), and relatively four small towns, Gwelo, Gatooma, Umtali and Fort Victoria, with populations of 2-3000 each. The remaining population is widely distributed in smaller townships, mining centres, and farming areas.

Natives - 1,500,000, (approximate)

Mainly indigenous, Matabele, a tribal relation of the Zulu of Natal and localised to Matabeleland (Bulawayo). Mashona tribe localised to Mashonaland (Salisbury). Both are segregated in native reserves - large areas of land set aside for the native. In these reserves the native has no contact with the European apart from Government officials (Native Commissioners, Government Medical Officers, and Police), missionaries and native Truck Traders. The native policy of S. Rhodesia is directed by the Imperial Government, that is the Colonial Office, London.

The male native is the labour of the Colony, and he is employed largely in the bigger cities, in domestic and commercial service, on farms, in mining industries and transportation services, (Railways, Road and Electricity Supply Commission).

Three decades/

Three decades ago the European population was only 20,000, and the number of natives employed was relatively small. To-day with a large increase in the European population, the natives have increased proportionately in domestic and commercial spheres of employment.

The native now tends to travel more, by bicycle, train, motor bus, and even by motor car, rather than on foot. The spread of an endemic disease such as Schistosomiasis has run a parallel course. In 1945 a census of the native populations residing in the municipal areas of Bulawayo and Salisbury was 30,000 in each, which meant that these cities had an all-in population of 50,000 subjects.

There is a small Indian and coloured population of 3-4000 (approximate) centred mainly in the two big cities and the smaller towns. In the two cities and four towns modern amenities are to be found - water borne sewage, modern water supplies, and up-to-date conservancy methods under the local authorities with a Medical Officer of Health in charge of the Department. The smaller towns under Village Management Boards have no such amenities. Water here is largely obtained from wells. Sewerage is by/

is by the bucket system (night soil), or chemical sanitation, e.g. septic tanks and Elsan closets. Conservancy methods are practised in some modified fashion. Many country hotels and residences and farm houses have modern sanitation, e.g. septic tanks or Elsan closet.

These conservancy measures apply to the European population. The natives employed in the bigger cities with municipal services enjoy similar facilities.

The majority of natives, therefore, are accustomed to a "Kraal life" in their native reserves using their primitive methods of conservancy. Those employed on farms and mines and smaller townships are provided with bucket systems, but, and this more commonly, they revert to their Kraal habits.

The S. Rhodesia Government with its Medical Department and the Director of Medical Services as administrator, provide hospital services for both European, coloured (Indian and coloured), and native.

Modern hospitals with up-to-date equipment and an efficient nursing service are provided, and the sick European may be attended in these institutions by his or her own medical attendant. One private hospital in Salisbury and a number of private nursing homes/



homes are also available in the two cities.

The Government undertakes the full responsibility of preventive and curative medicine for the native subject except in municipal areas, where Infectious Diseases Hospitals under the administration of the M.O.H. of the city are provided for the European and native.

The Government Service employs a European medical staff (G.M.O's), whose duties apart from their native work include the treatment of European paupers, the conduction of School Inspections, and the visitation of Government School Boarding Houses and Prisons. The Gov. Med. Officer, stationed in the rural areas, supervises and administers native clinics which draw their cases from the native reserves. During the past ten years there has been a big increase in the number of these clinics and an appreciable advance in both preventive and curative medicine has resulted to the African native.

The many Mission stations in S. Rhodesia which receive state grants also supply medical services to the natives in their areas, their work being mainly preventive.

Public Health Laboratories are situated in Bulawayo and Salisbury and a Schistosomiasis Research Laboratory is in operation at Salisbury.

Reference/

Reference to the distribution and incidence of Schistosomiasis in S. Rhodesia has been made by Blackie (1932), who found with one exception *S. haematobium* and *S. mansoni* in all parts of S. Rhodesia that he investigated. In the Malsetter District only was *S. mansoni* found to be slightly more prevalent than the *S. haematobium*.

Recent work by Mozley, Director, Schistosomiasis Research Laboratory, Salisbury, (1939 - May 1945), found a similar distribution of the disease. The Inyanga area of the Eastern Districts where the elevation is 7000' above sea level has, however, been free of the parasites for over ten years. Mozley carried out an extensive survey of the whole of S. Rhodesia and apart from the Inyanga area and one or two rivers running over rocky strata and free from vegetation, he condemned the whole river and water system of S. Rhodesia.

In the European, an assessment of the infection rate has not been attempted up-to-date. It can be assumed, however, that the rate is a relatively high one and has steadily increased during the last two decades.

Alves and Blair (1945) in a survey of school children/

children tested at Salisbury, and using a Cercarial Skin Test Antigen, and stool and urine examinations, revealed an infection rate between 50-55%.

In the African, while certain foci of high infection rates exist, the total infection is probably about 50%, Alves (1946).

Reference to map I will show S. Rhodesia in relationship to the other part of the African continent.

Map II gives a detailed geographical picture of the country with salient features indicated:

Altitudes.

The River System.

Cities and Towns.

Native Reserve areas.

Endemic areas of Schistosomiasis.

No well defined seasonal occurrence of Schistosomiasis is to be found in S. Rhodesia. Infestation is less likely to occur in the wet season (November to April) than in the dry and hot seasons (May to August and August to November). In this respect Schistosomiasis does not follow the seasonal trends of malaria (infective parasite Plasmodium Faiciparium), the other important tropical disease which reaches epidemic proportions in the three months period February to April, that is towards the end of the wet season.

The policy of the S. Rhodesia Public Health Department each year is, therefore, to control and apply preventive measures against malaria for the first three months and to implement the campaign against the Schistosomiasis problem for the remaining nine months.

Schistosomiasis affects all races, colours, and creeds. It was particularly noticeable during the war years 1940-45 that the R.A.F. personnel sent to S. Rhodesia under the Empire Air Training Scheme, were affected readily, when exposed to the risk of infestation.

In similar manner the newly arrived immigrant to S. Rhodesia, ignorant of the cause of the disease and how/



and how it is transmitted, has been susceptible.

No well defined resistance factor has been met with in Schistosomiasis - the Rhodesian born subject has no apparent natural tolerance or resistance to the disease. However, the author in common with other medical colleagues has met with the situation, where a number of persons have bathed in an infested river and some weeks later all, except one or maybe two, of the number show classical symptoms and signs of the disease with demonstrable ova in the urine and/or stool.

DIAGNOSTIC METHODS.

Method 1. The History of the Case:

Every patient has to be investigated with due caution, even when no history of risk of infestation has been advanced. In children and young adolescents, particular attention must be exercised. "In this regard the author of this treatise has been impressed by the not infrequent history advanced by the parent and substantiated by the school teacher of the school child who has shown "a gradual loss of form and place in the class together with a physical and mental retardation - the child is dull, dispirited, cannot concentrate and appears lazy; from a bright, alert pupil attaining a high position in the class there is a progressive drop in school performance". Schistosomiasis has been diagnosed in these cases with presence of ova in stool and/or urine and the author has come to the conclusion that this disease has a bearing on the mental and intellectual retardation in school children.

In adults frequently no definite history has been forthcoming, but the astute practitioner, keeping in mind the occupation of his patient, be he farmer, miner, or employee on the Railway Service, has realised the inadvertent risk of infestation that his patient/

patient has run. Similarly although the city and town dweller has undoubtedly a brighter prospect of avoiding infestation one has to appreciate the fact that the Rhodesian sunshine and the wide open spaces have an attraction to the citizen; at weekends and holidays he and his family have found a popular release from city pursuits. Rivers and shady water courses are favourite localities for picnics, fishing, boating, etc, and the risk of infestation does result from these excursions.

In the author's experience possible cases of infection cannot be excluded on the evidence of medical history alone and other diagnostic measures must be used to investigate the case as follows:-

Method 2. The Clinical Features:

of Intestinal (*S. mansoni*)  
and Vesical (*S. haematobium*) Schistosomiasis.

Schistosomiasis is a chronic inflammatory disease and the classical signs and symptoms of vesical Schistosomiasis with predilection for the urinary tract and haematuria; of intestinal Schistosomiasis with blood and mucus in the stool, vague abdominal pains and loss of weight, are well known and with demonstrable ova in the urine or stool, diagnosis in these cases is not difficult.

To quote/

To quote Gelfand (1942), "Bilharziasis is a chronic inflammatory disease. The symptoms and signs may, therefore, be general or constitutional, etc. Involvement of certain organs such as the liver and spleen, appendix, Fallopian tubes, Gelfand (1941), testes, Gelfand and Davis (1940), and especially the bladder and bowel should always make one consider the possibility of Bilharziasis in the territory". The diagnostic pitfalls at once become apparent.

Gelfand (1942) stated:-

"Attention has been concentrated too much on these local symptoms in the bowel and bladder and the general constitutional symptoms have been overlooked so that diagnosis is often missed if local symptoms are absent or so mild that they are not observed by the patient".

In the author's experience this has applied particularly to the infestations with *S. mansoni*, though a similar constitutional disturbance has frequently been seen in *S. haematobium* as well.

*Schistosoma mansoni* almost invariably involves the large bowel and is rare in the bladder. There may be no bowel symptoms, the patient stressing his lack of energy and loss of weight.

Three main/



Three main Clinical Varieties of both intestinal and vesical Schistosomiasis exist in S. Rhodesia.

Group I .

This is the largest group where the patient shows symptoms and signs of urticaria, pyrexia, and a feeling of malaise occurring within a few weeks of exposure to infection. At this stage the cercariae are still in the blood stream. This invasive stage is called Katayama, a disease found in Japan and elsewhere; the stage persists for only a short time, one to two weeks, and the diagnosis may be missed. Gelfand and Osborne (1943) reported the first case of Katayama to be described in S. Rhodesia.

The important features of the syndrome which appear 4-6 weeks after exposure to infection are:-

1. Irregular and remittent fever lasting 3-8 weeks.
2. Urticaria on any part of body with severe itching, and
3. Eosinophilia, appearing after the subsistence of the systemic symptoms and soon reaching its maximum.

The appearance of this syndrome should call early Bilharzia to mind even though repeated examinations of the urine and stool are negative.

Wright and Roberts/

Wright and Roberts (1944) described a creeping eruption with intense eosinophilia in a case of infestation by *S. mansoni*. The author of this thesis considers that the case described was in fact one in the category of Katayama Syndrome.

Group II, in reference to intestinal (*S. mansoni*) Schistosomiasis.

General symptoms may occur with ova in the stools, but the patient may not observe any untoward signs, viz, blood and mucus.

Notable symptoms and signs are:-

Debility and lack of energy.

Early loss of appetite (anorexia).

Flatulence and gastric pain which may simulate early peptic ulceration or cholecystitis with jaundice.

Cawston (1931), reported a case of Bilharziasis complicated by jaundice and Stein (1938) found at autopsy on a Bantu, *S. haematoma* ova in the gall bladder and bile ducts.

Pyrexia may be present for several days - Knott (1937), reported this symptom in two cases of *S. mansoni* infestation.

A hacking cough and/or asthmatic symptoms, due to the irritation of the lungs by the ova and which may/

which may result in fibrosis of the lung leading to dyspnoea and failure of the right heart.

Mainzer (1938) described Bilharzial asthma and bronchial asthma in Schistosoma infections - the author of this thesis has himself treated two such cases.

The presence of Eosinophilia - In Gelfand's (1942) series of cases 1/3rd showed this phenomenon. He maintained that eosinophilia was less frequent in the later stages of the disease and that it was only rarely high. A slight to moderate hypochromic anaemia was observed in many of his cases. Blood sedimentation rate increased in more than half of his (Gelfand's) cases. Gelfand did not think mental retardation and epileptiform seizures were due to Bilharziasis.

In this regard Hoff and Shaby (1939) have found nervous and mental manifestations which they considered were due to Schistosomiasis infection. No further facts have been obtained from the current literature to advance the view that Schistosomiasis has precipitated psychosis and other somatic nervous disorders.

Trim (1943) mentioned the presence of small, rubbery, discreet/

discreet lymphatic glands in groins and axilla, and he maintained that their presence was an aid to diagnosis in *S. mansoni* infestations.

Keiser (1934) commented on a nervous facial tic (one case) and stammering (two cases) in children with active Schistosomiasis infestation. These objective phenomena lessened appreciably after a course of an active therapeutic drug had been given. Cawston (1934) considered that these phenomena might be associated with an entoxin liberated by the viable male and female Schistosome in the body.

In Group II - later manifestations on the disease mainly related to the bowel:

Abdominal pain, periodic and usually mild.

Diarrhoea with blood and mucus and ova in the stools.

Constipation may be the main symptom.

Gelfand (1942) did not agree that haemorrhoids and pruritus ani were caused by *S. mansoni* infestations.

Bercouitz and co-workers (1945) studied the proctoscopic picture in asymptomatic Schistosomiasis (*S. mansoni*) infestations, and they drew the following conclusions. "In areas where the presence of *S. mansoni* is suspected careful examination/



examination of the faeces should be made regardless of the absence of any signs or symptoms of the disease".

Samy (1936) stated that anal fissures started as Bilharziasis at anal margin. Clinically they were fissures with ova demonstrable in the scrapings.

Gopsill (1932) observed the occurrence of rectal Bilharziasis in the Chota District, Nyasaland, including certain eye changes. The latter sign he considered helpful in diagnosis: "blackish blue patches occurred scattered about the sclera of the eye". The author of this work has not observed this phenomenon in any of his cases.

Meira (1941), conducted recto-sigmoidoscopy and radiological examinations in the large bowel of cases with *S. mansoni* infestations and he concluded from this work, that no lesion was diagnostically specific and diagnosis has to be established by microscopic examination of faeces.

Caldas (1941), reported on one case of Schistosomiasis of the rectum but ventured no opinion.

The author of this thesis has had two cases of pruritus ani which on proctoscopic examination and scrapings gave no evidence of Schistosomiasis.

In Group II /

In Group II - later symptoms that have been observed in cases of vesical Schistosomiasis:-

Constitutional symptoms have appeared from 3-9 months after infestation with or without ova in the urine.

The classical symptomatology of this condition has been completely absent, in many cases the patient being unaware of symptoms and signs referable to his urinary tract. Notably, as in intestinal

Schistosomiasis, similar constitutional symptoms of early loss of appetite, debility, lassitude, loss of weight and eosinophilia have been observed.

The symptoms and signs localised to the urinary tract that the author of this thesis has noted from time to time were:-

The earliest - burning urethral pain on micturition.

Later - terminal haematuria - constant or during periods of a few days with clear intervals of several months.

Urgency and frequency of micturition.

Perineal pain and aching in the loins.

Haematuria - bright red - aggravated by violent exercise.

Pain - not a dominant clinical feature, but may be urethral, perineal, supra-pubic or renal in distribution.

Other /

Other genito-urinary and renal symptoms, where the prostate and seminal vesicles are involved by the disease, e.g. haemospermia.

The author of this thesis studied these features of the disease in men engaged in active military manoeuvres during the war years 1940-45 in S. Rhodesia.

Black (1945) described cutaneous eruptions on the trunks of two, and probably four, of his cases suffering from active *S. haematobium* infections.

In Group III the clinical features of the disease occurring 7-10 years or earlier after infestation in intestinal Schistosomiasis infections have been observed.

Live ova in the liver have caused hepatitis and late cirrhosis of liver and splenomegaly (Egyptian splenomegaly and Banti's disease), especially in the untreated native.

Cirrhosis may not develop for many years being preceded by repeated attacks of transitory jaundice which may closely resemble infective hepatitis.

On reference to the literature one finds that:-

Almy and Harper (1944) described a case of an Arab resident in U.S.A. with Banti's syndrome apparently due to infection with *S. mansoni*; the characteristic feature being the chronicity of the disease of some 30 years.

Giffen (1945) described Schistosomiasis and Egyptian splenomegaly, while

Day (1933), on the same subject put forward the view that splenomegaly was dependant on venous stagnation which gave rise to the symptoms of hepato-splenic syndrome.

In the undiagnosed and untreated cases when cirrhosis has developed, death may supervene from pneumonia, tuberculosis/



tuberculosis, cholaemia, portal and mesenteric thrombosis, cancer of liver or lung, haemorrhage, heart diseases, Stokes-Adams syndrome.

Mainzer (1938), observed various clinical aspects of pulmonary diseases induced by Schistosomiasis.

"In this condition as in no other pulmonary disease there is mostly a striking discrepancy between the smallness of the clinical findings (obtained by percussion as well as auscultation), and the intense changes of the lungs shown by skiagram".

These late manifestations of the disease are rarely seen in the European, but are common to the untreated native case in S. Rhodesia.

Sanabria (1944), studied electro-cardiographs in Bilharzial myocarditis and concluded that no typical E.C.G. signs are present in the condition.

Meira and Ramos (1944), used electro-cardiograms in *S. mansoni* infestation cases, 20 in all, and some complicated by presence of other pathological conditions in some cases. Their conclusions were that two kinds of myocarditis may occur:

1. Very rare - Schistosomal granuloma in the myocardium.
2. Common - not well known and confused with Fiedler's myocarditis but should be distinguished from it.

Sanabria/

Sanabria (1943) also described two cases of the Stokes-Adams syndrome due to Bilharzial myocarditis. In Group III the features of the late stages of vesical Schistosomiasis have been:-

In the untreated case, a chronic course results, but spontaneous recovery has been known to occur. If repeated infestations or relapses from course of treatment have occurred, fatal complications such as uraemia, urinary sepsis, carcinoma of the bladder, prostate and other viscera, may occur.

In the treated case, and in the relatively early infested case of 1 to 10 years, symptoms that have been frequently observed were:-

General debility, anorexia, loss of weight and marked degree of asthenia. Some degree of hypochromic anaemia - Greig (1940) quoted a case of chronic vesical Schistosomiasis with a marked degree of hypochromic anaemia but which responded dramatically to a course of active therapeutic treatment with increase in the haemoglobin content. Attacks of acute abdominal colic due to ureteric strictures, the predilection site being the right ureter and ureteric calculi; and simulating an acute abdominal emergency. This condition has required the most careful clinical examination to differentiate/

differentiate it from acute appendicitis, acute pyelitis, acute cholecystitis, and gall stone colic, duodenal ulcer, and, in young women, ectopic gestation before rupture.

The clinical features of both intestinal Schistosomiasis and vesical Schistosomiasis have been shown to have a predilection for the generative systems as well, and a word on the female sufferer from the disease requires consideration.

The clinical features have been described by:-

Symmers (1906) who was indeed the first to describe Bilharziasis of the Fallopian tubes.

Gilbert (1943) on a survey of Schistosomiasis (Bilharziasis) of the female genital tract and neighbouring tissues found all his cases were due to the Schistosoma haematobium infestation and not to Schistosoma mansoni. On various cases he performed laparotomies. He was impressed by the characteristic "colossal" fibrosis which has a predilection for the broad ligament.

Gelfand (1941) described the clinical features of Bilharzial salpingitis in S. Rhodesia.

In young women passed the menarche no characteristic clinical menstrual dysfunction has been noted. In married women, however, menorrhagia and sterility/

and sterility have been observed. The author of this thesis has treated three cases of absolute sterility due to chronic Schistosomiasis in 1944-45.

### Method 3. Chronic Bilharzial Appendicitis.

The author of this thesis draws attention to the not infrequent incidence of Bilharzial lesions of the appendix in S. Rhodesia. The clinical signs and symptoms and a significant pathological feature of the disease requiring further research are discussed. The differential diagnosis is likewise considered.

Reference to the current medical literature is enlightening on this aspect of the disease.

Epstein (1934) stressed the frequency in S. Africa of both acute and chronic Bilharzial appendicitis in the European and native.

Rosin (1944), ten years later, made a similar statement on S. Rhodesia.

The severity of these lesions has been confirmed and has assisted in definitely establishing the pathological and clinical diagnosis of chronic Bilharzial appendicitis.

Carlisle/



Carlisle (1942) recommended the designation of chronic Bilharzial appendicitis on specific pathological grounds. He found that acute and subacute exacerbations frequently occurred in chronic Bilharzial appendicitis.

In Salisbury, S. Rhodesia, during the last six years, increased facilities have been afforded the medical practitioner to diagnose the unsuspected case of chronic Bilharzial appendicitis. The staff of the Public Health Laboratory and Pasteur's Institute has conducted a fuller pathological investigation of the appendices submitted for histological examination during this period.

The essential pathological process has been proved to be a chronic inflammation, the ova being deposited in the outer mucous layers and these have caused a cellular infiltration which led to the formation of the characteristic pseudo-tubercles of Bilharziasis.

Carlisle (1942) stated that the histology of the disease was closely allied to that of tuberculosis, syphilis and other types of infective granulomata accepted as true examples of chronic inflammation.

Lovett-Campbell/

Lovett-Campbell and Rose (1936) made this observation: "Bilharziasis causes its own type of appendicitis, the symptoms of which occasionally become urgent enough to warrant surgical intervention, the gross pathology encountered bears this out."

The sequelae to infestation of the appendix over an indefinite period of years have been found to be either a chronic Bilharzial appendicitis - the larger group - or where an acute inflammatory process has become superimposed - a smaller and more dangerous group. Delay in resorting to immediate surgical intervention has led to serious intra-abdominal complications, e.g. abscess formation, perforation and gangrenous changes of the appendix. An observation of histological and pathological interest has been that although *S. mansoni* has been proved to be the infecting agent in cases of intestinal Bilharziasis, yet in every case but one quoted in the literature *S. haematobium*, the vesical Schistosome agent, was found in the digested appendix tissue.

Torres (1940) reported a case of appendicitis due to *S. mansoni*; histological examination of the appendix revealed ova of *S. mansoni* in the lumen and adult male and/

male and female in copula in a section of the meso-appendix. The stool of the patient also contained ova of *S. mansoni*.

Stewart (1930), one case; Sargent (1937), one case; Lovett-Campbell and Rose (1936) 35 cases; Rosin (1944) 64 cases; and the writer of this treatise on 3 cases, all revealed the presence of *S. haematobium* in the digested appendix tissues.

Lovett-Campbell and Rose (1936) observed that where there were very many ova there were not always gross lesions, while two cases with gross lesions had few ova.

A satisfactory explanation for the extraordinary migratory passage of *S. haematobium* to the appendix has yet to be pronounced and why the *S. haematobium* has a consistent predilection for the appendix may only be conjectured at on the grounds that such a case has in fact been suffering from vesical Schistosomiasis. How does the *S. haematobium* find its way to the appendix? An anatomical and vascular explanation or even a metamorphosis may occur. There may be a direct connection between an infected right ureter and an adjacent appendix to account for the transmigration. This phenomenon offers a useful field for research.

In cases/

In cases of chronic Bilharzial appendicitis studied and treated by the author of this thesis a clear history of early urinary symptoms and signs was rare. The subsequent findings of infection of the appendix was, therefore, a late manifestation of the disease occurring years after the initial infection. In many cases the patient was unaware of having had any symptoms and signs of the disease.

In the three cases described by the author no active urinary or intestinal lesions could be demonstrated, repeated urine and stool examinations were negative and eosinophil counts have been within normal limits.

Where no acute exacerbation has occurred the clinical picture was one of chronic appendicular colic or gastralgia, classically described by Moynihan. The symptomatology of these cases falls into two groups.

The dyspeptic, simulated by the triad, duodenal ulcer, gall-bladder disease, and appendicitis.

The colic, with intermittent attacks of mild abdominal colic as the significant clinical symptom, though constitutional symptoms, e.g. loss of weight, anorexia/



anorexia, constipation and general lassitude have appeared in many cases.

A history of previous vesical Bilharzial infestation may or may not be given.

Radiological investigations by barium series has not assisted greatly in determining the pathological lesion in the appendix; at most it has excluded or defined a suspected peptic ulcer and may reveal a filling defect in the lumen of the appendix.

On clinical examination deep pressure on palpation over McBurney's point may elicit tenderness and discomfort to the patient. Lovett-Campbell and Rose (1936) in their report on 35 cases stated that ova of *S. haematobium* were present in the urines of all and in 20 of these appendices, ova of the Schistosome were found. In only 4 cases were the colicky symptoms held to be accounted for by the gross lesions present in the appendix.

The diagnosis of chronic Bilharzial appendicitis has always produced difficulty and one has been guided by various factors to determine whether the condition warrants active surgical intervention or not. Pijper (1934) has observed the rapidly/

the rapidly increasing numbers of appendices with *S. haematobium* ova in situ, on submission to the laboratories in S. Africa for examination. He asks, "If chronic appendicitis and blood test for Bilharziasis is positive then is one to substitute operation for active antimony therapy?" In view of subsequent knowledge and research into this subject of Schistosomiasis the author of this thesis and others maintain that a combination of both measures would offer the best line of approach in these cases. Barsoum (1932) thoroughly examined 50 appendices histologically after removal for appendicitis and showed that 19% had *S. haematobium* ova. He maintained that Schistosomes did not cause appendicitis in Egypt where the population was heavily infested with these parasites but appendicitis among them was rare. This hypothesis has not met the situation as it pertains to S. Rhodesia and S. Africa.

The second group of cases, where an acute exacerbation of symptoms of appendicitis have supervened, gave rise to a typical clinical case of acute appendicitis, with pain, vomiting, pyrexia, accelerated pulse rate, furred tongue, and constipation./

constipation. Examination of the abdomen has revealed a localised tenderness and rigidity over McBurney's point often extending down to the thigh. Levine and Marin (1935) reported a case of carcinoma of the appendix with Schistosomiasis.

Considerations in the differential diagnosis of these cases have to be considered.

In the acute case little difficulty has been met with apart from the other forms of acute abdominal colic, e.g. acute renal colic due to ureteric strictures of Bilharzial origin, and acute biliary colic confusing a case of retrocaecal appendicitis. In women acute pyelitis of pregnancy, salpingitis, right-sided ectopic gestation, before rupture, and torsion of ovarian cyst pedicle have to be eliminated.

In the chronic case, however, acute heart failure with congestion of bases of lungs, chronic cholecystitis, diverticulitis and peptic ulcers. Renal and ureteric calculi in tropical and sub-tropical countries, amoebic and bacillary dysentery, acute infective hepatitis and chronic malaria were the diseases that have confused the diagnosis in S. Rhodesia.

Differential Diagnosis in Vesical Schistosomiasis and  
Intestinal Schistosomiasis.

Schistosomiasis in both its forms may mimic a large number of other diseases and exclusion of these must be sought. Emphasis on the frequent occurrence in S. Rhodesia of mixed infections is stressed.

From:-

Chronic malaria, the commonest tropical disease in the country, has been frequently met with in conjunction with Schistosomiasis. Diagnostic methods by examination of blood smears in the acute case (*Plasmodium Falciparum* in S. Rhodesia) together with the history and examination of urine for urobilin have made the differentiation clear.

From the other Helminthic diseases:

*Ankylostoma duodenali*, *vermicular oxyurius* and other Nematoda and Trematoda infections, have an appreciable incidence among the European population in S. Rhodesia. The native has been a heavy sufferer from ankylostoma, and the risk of infestation to the European has, therefore, resulted.

*Taenia Soleum*/



Taenia Soleum and Taenia Saginata have been met with - it has been observed that the Rhodesian citizen has become infested while on holiday in Natal, S. Africa. The large Indian population in that territory has a high infestation rate to this Helminthic parasite. Trichimonis is also found in S. Rhodesia.

To differentiate these Helminthic disease from Schistosomiasis, careful stool examinations must be performed. The Eosinophil Cell Count is raised to percentage increases corresponding to those in cases of early Schistosomiasis.

From Tropical Anaemia or Sprue:

This disease has become more prominent within recent years. Gelfand had three cases, and the author of this treatise one case in 1944.

From Tropical Eosinophilia:-

A rare disease in S. Rhodesia. The author had an interesting case in 1944. A young female who gave a previous history of S. mansoni infection and for which anti-Bilharzia treatment had been given at an earlier date.

From Tropical Asthenia:

A syndrome rather than a disease and well recognized in S. Rhodesia. Its occurrence has been attributed/

attributed to various factors:-

1. Environmental influences including high altitude, climatic considerations, and long residence in the territory.
2. Exposure to the sun rays over a period of years intensified by the wearing of unsuitable clothing and lack of protection to the eyes, head and neck.
3. The "sundowner" habit (alcoholic liquors taken 6-7 p.m.) in excess of moderation and the laissez faire attitude of the colonial resident.
4. Dietary deficiencies particularly avitaminosis to some degree and a lack of B<sub>1</sub> and B<sub>2</sub> and C components has resulted in a lowered resistance.

The clinical picture has these features - general debility, loss of weight, anaemia and low blood pressure, and chronic anaemia, with a moderate degree of hypochromic anaemia.

From both Amoebic and Bacillary Dysenteries:

The bacillary forms have been more common and seasonal incidences occur mainly in the hot season affecting both children and adults.

Careful investigation has been required to differentiate these tropical diseases from Schistosomiasis.

Virus diseases have been rare in S. Rhodesia but acute/

but acute hepatitis has come to the fore since the African campaign in Libya and W. Africa 1940-43.

A disease which has been difficult to differentiate from Schistosomiasis in the early stages.

From Neuro-circulatory asthenia syndrome:

The recent war years brought in its train this functional condition of ill-health and debility resulting from mental and physical overstrain and fatigue. Adult males in their prime were most susceptible. The syndrome has a relationship in aetiology to tropical asthenia.

From the respiratory and gastric types of influenza together with the post-influenzal debility states:

This disease has a definite seasonal periodicity in S. Rhodesia, mildly epidemic in form and appearing during the dry months, August to October. The disease has been present since the influenza pandemic of 1918.

From Hypoglycaemia with low blood sugar tolerance, and another functional syndrome. Since 1939 and the succeeding war years the number of cases affected has increased appreciably.

From Pulmonary Tuberculosis:

A chronic inflammatory disease similar to Schistosomiasis has regrettably made further advances/

advances in S. Rhodesia during the last decade.

Silicosis has also to be excluded in this group.

From chronic Cholecystitis and gall-stone colic - relatively of frequent occurrence in the country.

Stein (1938) described the case of a Bantu with S. naematobium ova present in the gall-bladder, while Makar (1937) was reputed to have reported the first case of Bilharziasis of the gall-bladder in a living subject.

From Peptic Ulcers, which have been very prevalent in S. Rhodesia.

Chronic appendicitis (non-Bilharzial), acute and chronic colitis and other large bowel diseases, e.g. diverticulitis, and chronic pancreatitis, have all to be differentiated from a suspected case of Schistosomiasis.

The following allergic conditions have also to be excluded:

Bronchial asthma, fibrosis of the lung, and psoriasis. Nervous disease, though not common in S. Rhodesia, cases of subacute combined degeneration, disseminated sclerosis and transverse myelitis have been found in association with Bilharziasis. Day and Kenaway (1936) described a case of Bilharzial myelitis and Bayoun (1939) also reported a case.

Blood diseases/



Blood diseases met with in S. Rhodesia and requiring differentiation from Bilharzia have been - pernicious anaemia, the leukaemias and the purpuras. Mixed Helminthic infestations have been observed frequently in children and young adolescents.

In order of their frequency have been Vermicularis Oxyurius, Ankylostoma Duodenala, and Taenia Soleum, and Saginata.

Gardia Lambia infections giving rise to large bowel colon disturbances have also been found.

Chronic malaria with hypochromic macrocytic anaemia and avitaminosis has been found, particularly in the African, less in the European child, and least of all in the European adult.

The syndrome tropical asthenia common in the Rhodesian child has been associated with the precocious physical development and slower mental development that has been an observed fact during the child's adolescence. In the author's opinion the effects of the sun rays and the lack of a holiday change to sea level over a period of years, have had a detrimental effect on the health of the Rhodesian child.

Method 4.

Examination of the Haemopoetic System is of diagnostic importance in determining the presence of Schistosomiasis.

The significance of the Eosinophil acid white cell count has pride of place in this respect. Red blood counts have proved of assistance in revealing hypochromic macrocytic anaemia and to exclude other red cell diseases.

The haemoglobin percentage has been a useful guide to determine the extent of the anaemia.

Total white blood count and differential white blood counts determine the eosinophil cell percentage and exclude the leukamic diseases, and septic conditions which follow the long standing chronic cases of Schistosomiasis.

The eosinophil count has been found to be raised in the first 6-8 weeks after infestation by the Schistosome and have reached percentage levels of 20-40% in the Katayama stage of the disease. In the later stages of the disease, the eosinophil count has not assisted in the diagnosis appreciatively, and a percentage count of 3-5% falling within normal/

normal limits of a differential white blood count has frequently been seen in these cases. Mainzer (1938) observed a reactional increase of the eosinophil proportion of the blood in Schistosomiasis subsequent to antimony treatment. A phenomenon in support of the recognition of latent infection.

Method 5:

The Blood Sedimentation Rate.

The rate has been observed to increase in certain well-defined diseases of which Schistosomiasis is one. The rate has been calculated by finding the depth in mm. of clear plasma which has been found at the top of a vertical column of blood by the end of one hour. The blood for examination diluted 4 parts to 1 with a 3% sol. of sod. citrate.

Various workers have reported on the use of the blood sedimentation rate as well as the other blood examinations in the diagnosis of Schistosomiasis. Gelfand (1942) found the blood sedimentation rate increased in his cases. Bercouitz with co-workers (1945) stated, however, that their findings of differential blood counts and haemoglobin in cases of active Schistosomiasis closely resembled those of a control group of 450 healthy males in Porto Rico, West Indies. Rodrignes, Malina and other co-workers (1935) did a similar survey of red and white counts, haemoglobin platelet count, cell volume, colour index and differential blood counts on a series of cases, but for all their exhaustive investigations their results did not prove conclusive. Scuderi (1931) working on allied Helminthiasis (the ankylostomias/



ankylostomias) cases formed the following conclusions.

1. The blood sedimentation rate was markedly accelerated.
2. The rate returned to normal after specific treatment.
3. If the rate remained the same after treatment as before, the inference was that the Schistosomes were still alive, and
4. A cure can be considered likely if the blood sedimentation rate has returned to normal.

The author of this thesis has had limited experience in this diagnostic method. Conclusions drawn from writers in the literature and from his own experience have indicated that the blood sedimentation rate has proved of assistance as a diagnostic method for cases of suspected Schistosomiasis.

Method 6: Microscopic examination of urine and stool has a most important bearing on the diagnosis of a suspected case of Schistosomiasis.

Microscopic examination of the centrifugalised deposits of urine, a simple procedure calling for little expenditure of time and energy, has confirmed the diagnosis by the finding of the Schistoma haematobium ova. The examination of the specimen, normally performed at the laboratory, has been conducted with ease and success in one's surgery or native clinic on numerous occasions. In S. Rhodesia, native trained laboratory technicians have proved quite capable, after suitable instruction, of carrying out these investigations.

It has been the author's routine practice to submit three urine specimens (as a minimum) for examination and these to be taken on successive or alternate days. The specimen first voided after rising in the morning has been favoured. The author of this thesis has relied on a minimum of three negative urine reports before subjecting the case to an extensive investigation to determine the final diagnosis.

In the author's opinion there has been no real advantage/

advantage in taking a specimen of urine towards the end of a voidance rather than at the commencement or during the flow. But as terminal haematuria has been a feature of vesical Schistosomiasis, the end portion of the early morning specimen has been taken for examination. Cawston (1939) insisted that the urine sent for examination must be the whole urine specimen!

A method of diagnosis in suspected vesical Schistosomiasis, when no ova *S. haematobium* have been found on repeated examination of the urine specimens has been described by Kunert (1939), who demonstrated that intra-venous injection of Bayer 205 provoked the production of ova by *S. haematobium*. He used a dosage of 3.0 gm. Bayer 205 in the diagnosis where spined ova could not be found in urine after repeated examination. Engelherdt (1942) confirmed this work, using a dosage of 1.0 gm. Bayer 205. The use of this method has not been adopted in *S. Rhodesia* owing to (a) difficulty of obtaining adequate supplies of the drug, and (b) the prohibitive cost of its use.

In examination of the stool and fluid portion of faeces/



faeces for Bilharzial ova (*B. mansoni*), a similar procedure to that for urine has been adopted. Unfortunately it has been a somewhat unsatisfactory and laborious method and many ova have undoubtedly been missed at these examinations.

Method 7:

Antigen Reactions and Skin Tests in the diagnosis of Schistosomiasis have been practised for many years. It has been a field which research workers have explored with enthusiasm during the last 20 years. Lt-Col. Clayton-Lane carried out a twelve years survey (1933) in regard to Antigen Reactions. He observed that during the previous 12 years about 100 papers dealing with Antigen tests had been published in the Tropical Diseases Bulletin. A summary of these works has been appended as follows:

Fairley & Jasdason (1930) and others.

Bachman (1928) for Trichomonis used Precipitin Reactions.

Fairley & Williams/



Fairley & Williams (1927) for Schistosomiasis tried Intradermal Reactions.

Fairley & Jasdason (1930-31) evolved a Complement Fixation Test which proved useful in experimental Schistosomiasis.

Khalil & Hassan (1932) made the following observations in a preliminary note on a New Skin Reaction in human Schistosomiasis, "It is not the skin reaction, but the antigen which is described as new". These workers used S. Bovis as an antigen for detection of Schistosomiasis by skin reaction.. Clayton-Lane commented on these works during the twelve years survey period (1923-33) as follows:- "Extract of Molluscan liver has proved unsatisfactory as an antigen owing to the presence of the snail tissue itself which does not play any part in the production of immunity reactions".

Hamilton-Fairley and others (1929) reported that they had surmounted this difficulty in differeny ways. Since 1932 further workers have published their researches. Hassan and Betashe (1934) described an antigen for the Skin Reaction in human Schistosomiasis using Fasciola Gigantica. Minning (1941) maintained that there/

that there were two kinds of antigens that could be used - (a) extracts of mature Schistosomes in alcohol or salt solution, (b) extracts of the digestive glands of snails infested with the larval forms. Worm extracts were not practicable because of the difficulty of getting enough mature worms. Skin tests have proved more reliable than the Complement Fixation Tests. In H. Fairley's opinion the Complement Fixation Reaction was a true antibody-antigen reaction and it showed a marked group specificity within the genus Schistosome. Risquez and Boza (1941) mentioned in a preliminary note, an antigen prepared from cercaria of *S. mansoni* obtained from Planorbis Guadeloup and injected intra-dermally. A positive + reaction in 20 minutes or as late as 24 hours occurred in cases with Schistosomiasis, 92% of his suspected cases gave a positive + reaction. Culbertson and Rose (1942) using a skin test with an antigen from pneumoneus medioplexus stated that "diagnosis is difficult if there are few or no ova in the faeces or urine and examination of these is useless if the worms are all males". Precipitin, Complement Fixation, Intra-dermal Skin Tests, have all been used as aids to diagnosis but it is difficult to get Antigens".

Pifano /

Pifano and Mayer (1944) investigating the Fairley Reaction in the cercarial stages of *Schistosoma Mansoni*, used as agent, alcoholic extracts of the hepato-pancreas of *Planorbis (australorbis) Glabrata* naturally infested with *S. mansoni*. They used two techniques:-

- a. A Complement-Fixation Reaction similar to Fairley's with heated inactivated serum.
- b. A reaction with fresh sera done by Rubinstein's variation of the method of Hult.

Their views were:- "Fairley's reaction has a practical value for the diagnosis of infestations with *S. mansoni* where a positive + reaction allows the conclusion that a *Trematodi* infestation exists, especially an infestation with Schistosomiasis. But as these workers encountered 2% of cases which were certainly infested with *S. mansoni* as parasitological examinations proved, yet showed negative reactions, means that a negative reaction does not definitely exclude the diagnosis of Schistosomiasis in suspected cases."

A survey of the literature, therefore, since 1932 revealed the fact that no

Precipitin Reaction/

Precipitin Reaction

Intra-dermal Reaction or

Complement Fixation Reaction proved

entirely satisfactory as a diagnostic method for Schistosomiasis. The main difficulty appeared to be the lack of adequate supplies of the necessary antigen

It was noted that Fairley's Complement Fixation Tests gave a 98% positive + reaction in cases of active *S. mansoni* infestation, but the 2% negative reactions occurred in cases that were clinically positive from a parasitological point of view.

In S. Rhodesia the facilities for using Fairley's Complement-Fixation Tests have not been made available for the use of general practitioners.

Alves and Blair (1945) Schistosomiasis Research •

Laboratory, Salisbury, S. Rhodesia, have been working on cercarial skin test antigen since July 1945. The author of this treatise has consulted these workers from time to time and since supplies of their cercarial antigen was released for the use of practitioners in October 1945 the author has made use of the material in his cases and has observed its value as a clinical diagnostic measure.

The Cercarial Skin Test Antigen has an action similar to the Tuberculin Skin Test.

The agents/



The agents used were - carbolic, saline and cercaria. The cercaria being obtained from infested molluscs *Physopsis Globosa* (*S. haematobium*) and *Planorbis Pfeifferi* (*S. mansoni*). These workers have experienced no difficulty in obtaining the cercaria for their specific antigen.

The control solution is a carbolic and saline one.

N.B. At the time the author left S. Rhodesia in January 1946, Alves (1945) and Blair (1946) were still carrying on research into the use of this antigen from a clinical point of view.

The technique of injection is as follows:-

An intradermal tuberculin type of syringe and short bevelled fine needle is used.

Dosage of Antigen is 0.05 ccs.

The method used:- A selected site on the forearm, preferably a hair free area is selected and the injection which must be truly intradermal is given to raise a bleb the size of a match head.

Reading the Test:- The wheal is observed after 10 minutes and again after 15 minutes from the injection time. "Late" reactions have not been observed or reported on by others using the antigen, so that if the reaction is adjudged "negative" after 15 minutes it is not likely to alter.

Negative/

Negative Reactions:- The wheal either remains almost the same size or disappears at the end of 15 minutes. Erythema per se has no significance.

Positive Reactions - two types occur:-

1. A round button-like swelling of the original wheal frequently accompanied by erythema. The swelling may attain the size of a threepenny piece or even larger and the wheal is distinctly raised up from the surrounding skin; pseudopodia formation may or may not appear.
2. A spreading flat type of wheal is formed and enormous variations in increase of size over the original "match-head" wheal are observed. Pseudopodia can usually be seen in this reaction.

"Border-line" Reactions:- A very slight increase of the wheal and they are difficult to interpret. A patient giving a "border-line" reaction should be most intensively investigated with the other Laboratory aids, urine, stool and blood examinations, before a decision is reached.

N.B. - The antigen should be kept in a refrigerator while not in use; remove 15 minutes before use.

Theoretically it is possible to produce false positive reactions in patients who are strongly allergic to cold by using an ice-cold antigen. The antigen is not to be used 6 months after the issue date on the label has expired/

has expired. A control series of cases was used by these workers in the initial stages of their work - a selected number of R.A.F. personnel newly arrived in S. Rhodesia from the United Kingdom were taken.

The author's interpretation of the Cercarial Skin Test Antigen was as follows:-

A negative result to the test gave conclusive evidence in favour of the patient being free from Schistosomiasis in any form. This has been substantiated by repeated negative examinations of the urine and stool and Eosinophil Percentages within normal limits. A positive result did not in all cases reveal an active Bilharzial infection but was presumptive evidence of the disease. The other methods of diagnosis are then commissioned to demonstrate the presence of the disease.

Alves and Blair (1945) found that 25% of their cases that gave a positive reaction could not be substantiated in a parasitological sense.

A "border-line" result necessitated the use of all the other diagnostic aids to exclude the possibility of active Bilharzia.

A negative reaction eliminated the non-active case from the active Schistosomiasis one.

In view/

In view of a 25% positive reaction, not being substantiated by actual demonstrable Schistosomes the physician was still compelled to investigate all the positive reaction cases with other diagnostic methods. The absence of ova in the urine and stool did not exclude the disease and a positive + reaction to this Cercarial Skin Test Antigen might indicate the presence of the male Schistosome only. The "border-line" reaction cases fell into the same category as the positive ones and they required the same intensive investigation in an endeavour to confirm the diagnosis.

Method 8: Cystoscopy as a diagnostic method in undiagnosed cases of vesical Schistosomiasis has proved invaluable.

Mills (1946) employed cystoscopy for initial diagnosis and subsequent review of his cases.

Campbell-Begg (1942) asked why was Bilharziasis so frequently undiagnosed? From a hundred cases he drew the following conclusions:- "Presence of Schistosoma/



Schistosoma cannot be excluded even if the patient has not lived in areas known to be infested or has not paddled or bathed in ponds or rivers. The first infestation may cause no symptoms. The absence of ova of Schistosoma from the urine is no proof of the absence of the infestation. In most cases except at the very onset of the attack, no ova will be found in the urine. Even if ova are passed from time to time the chances are remote that the urine will be examined at one of these times". In only 3% of his cases which were proved by cystoscopy to have active Schistosomiasis were ova found in the urine..... He maintained that cystoscopy was the only means of confirmation or exclusion of the disease. It was almost 'infallible'. He further emphasised that when the disease was active, urinary dysfunction has been absent or minimal and the only symptoms were lassitude, ill health, with or without abdominal pain.

When all parasites have died the sequela of the disease cause chronic ill-health. Dense strictures of the ureters usually in first 10-12 cms. above the bladder form and produce pain along the course of ureters. Campbell-Begg maintained that the ova have a predilection for the right side and the right inguinal region/

inguinal region; the maximum point of tenderness was the point wrongly taught as McBurney's, and this has led to erroneous diagnosis and operation for appendicitis. In his opinion the disease was the commonest cause of right inguinal pain in S. Africa and was a peculiar plague to the country. He stressed that S. African practitioners were not sufficiently "Bilharzia conscious".

These opinions were in accordance with the general consensus of opinion among practitioners in S. Rhodesia with one exception, the S. Rhodesian practitioner was actively "Bilharzia conscious". Fairley (1931) stressed the importance of early diagnosis of Schistosomiasis by cystoscopy when ova cannot be found in urine or faeces. Burt, Lane and Hamilton (1943) reported a case of Bilharziasis in a white missionary on leave in U.S. A. who developed a peculiar haematuria, S. haematobium were found in the urine. Christopherson and Ward (1934) described the cystoscopic appearances of the Bilharzial bladder before and after intravenous injections of Sodium Antimony Tartrate. Lowerthal and Roberts (1934) reported a case of Bilharzia affecting the left ureter and diagnosis was made by cystoscopy.

Vermeerten/

Vermooten (1940) described Bilharzia as seen by the urologist. Cawston (1939) considered that the cystoscope should not be passed in untreated cases for there were few bacterially infected cases which would not tolerate such a passage. Ockuly (1945) described a case, which following cystoscopic examination was diagnosed as a tumour of the bladder, but from the urine, ova of *S. haematobium* were found.

Method 9: Sigmoidoscopy as an aid to diagnosis in suspected cases of intestinal Schistosomiasis (*S. mansoni*), has been recommended by some workers.

Bercouitz and co-workers (1944) carried out a routine examination of army recruits in Porto Rico, W. Indies, and of 155 infested cases (in 13 *mansoni* ova were demonstrable in the stools), 94 were found to have small ulcers on proctoscopic examination. These ulcers had a predilection site below the recto-sigmoid fold. Their conclusions were:- "In areas where the presence of *S. mansoni* is suspected, careful examination of the faeces should be made regardless of any/

of any signs and symptoms of the disease.

Sigmoidoscopy was recommended in such cases".

Gopsill (1932) discussed the occurrence of rectal Bilharziasis in Nyasaland. Meira (1941) reported on 36 cases examined by recto-sigmoidoscopy and radiology, but he found no lesion diagnostically specific and in all, diagnosis was established by microscopic examination of faeces. Caldas, Magaltes and Colho (1941) have also used this diagnostic method. The author of this thesis has proved by experience that sigmoidoscopy was a useful procedure in the diagnosis of suspected cases of intestinal Bilharzia.

The author assessed the available diagnostic methods for Schistosomiasis as follows:-

The history has been found unreliable in many cases and especially so in children.

The clinical features, signs and symptoms and differential diagnosis have all been discussed fully from the diagnostic point of view. The author has formed the opinion that they assist in leading on to/



on to a final satisfactory diagnosis of the disease. Chronic Bilharzial appendicitis with Laboratory findings have been discussed and the importance of the disease stressed.

Full blood examinations, Eosinophil percentages and increased blood sedimentation rates have their place as diagnostic methods.

Skin Tests, particularly the Fairley Complement-Fixation Reaction and Alves and Blair's Cercarial Skin Tests Antigen Reaction, have proved of great value; the latter have the advantage of being inexpensive and easy to apply.

Cystoscopy has every justification for being used in all cases of suspected vesical Schistosomiasis (*S. haematobium*). Sigmoidoscopy has been found of value in the diagnosis of intestinal Schistosomiasis (*S. mansoni*).

To sum up the position a combination of all methods was proved to be the only safe and satisfactory way of coming to a diagnosis of Schistosomiasis, when no ova were demonstrable in the urine or in the stool.

## TREATMENT OF SCHISTOSOMIASIS

includes:-

- A. Preventive - prophylactic measures to control the disease.
  - B. Curative - active Bilharzial therapy - a means of destroying the parasites in the human host.
  - C. Surgical procedures where complications resulting from Schistosomiasis infestation has occurred.
- A. Preventive: A brief survey as applied to the disease in S. Rhodesia.
1. Intensive Public Health propaganda to inform and educate the public of the disease, its mode of spread, risk of infestation, and the measures to combat the disease. This work, though largely the concern of the Government Public Health Department, can obtain the assistance of the large commercial bodies, e.g. Railways, Mines, Farmers, etc, to conduct an enthusiastic campaign against the disease.
  2. Avoidance of washing, paddling, and bathing in any water, pool, or river, that is suspected of being infected.
  3. The storage of water for ablution and other household purposes. 48 hours storage was the accepted time considered safe to make infested cercariae/

cercariae innocuous and immobile. Alves (1945) at the Schistosomiasis Research Laboratory, Salisbury, in the course of research into the longevity of cercariae in storage water noted the following points:-

- (a) that they cercariae were influenced by temperature,
- (b) that they remained active in the water up to 93 hours in the June, July, August period, when the mean temperature of the country is at its lowest - 40-50° F.

4. The public to be warned against the danger of polluting the rural areas and rivers and other sources of water with any organic refuse.

5. Avoidance of fouling these sources of water with human excrement, and the African to be educated on this undesirable practice.

6. Chemical and other scientific methods of control.

Numerous workers have engaged in this aspect of Preventive measures against Schistosomiasis and Egypt has been the main venue in this respect for some 60 years. Khalil (1942) and Azim (1945) found copper sulphate ( $\text{CuSO}_4$ ) effective as a vermicide and a destroyer of the fresh water molluscs carrying the Schistosoma. The concentration of 7 parts per 1,000 being/

being adequate. Alves and Blair (1945) obtained very gratifying results with this copper compound. Mozeley (1941) advocated the use of Malachite ( a crude copper compound with base of copper carbonate). He proved that the solubility of copper carbonate was increased by the addition of powdered pods from a Rhodesian tree *Swartzia Madagascarensis*.

Other workers recommended Chlorine preparations (Calc Hypochloride) in strengths of 1 part in 40 for the destruction of cercariae. Cawston (1942) and others recommended the mechanical clearance of all vegetation from water ways and the liming of the soil of the river banks. Wager (1936) found a species of tree, *Balanitis Maughamii*, indigenous to S. Africa, to have powerful vermifugal powers against the cercariae. He advocated its use by the planting of these trees along river banks; and their pods with specific anti-parasitical properties would fall and act on the cercariae. For economic and other reasons, this method has been found impracticable. Cawston (1942) and Mozeley (1944-45) evolved the idea that species of ducks that feed greedily on *Planorbis Africana* should be stocked on farms, dams, and reservoirs. In S. Rhodesia many of these methods have been applied effectively.

B. Active/



B. Active Bilharzial Drug Therapy.

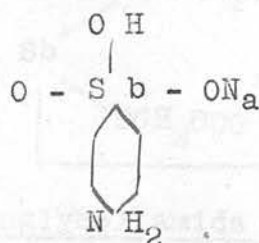
The specific drug treatment of human Schistosomiasis dates back to the independent announcement by McDonagh in 1915 and Christopherson in 1917 of the lethal action of Antimony on the causative intra-vascular parasites. These workers were the first to use successfully tartar emetic solutions given intravenously for cases infested with the blood flukes of the genus Schistosomidae. Since then, both tartar emetic (Potassium Antimony Tartrate) and Sodium Antimonyl Tartrate have been extensively employed. These drugs are to-day still generally held to be the most potent available for the treatment of human Schistosomiasis. The pentavalent Antimonials have proved ineffective in the treatment of Schistosomiasis. Before the Trivalent Antimonial Compounds were introduced the only alternative to tartar emetic was the Alkaloid Emetine, which proved useful. The method of action of Antimony on the Schistosomiasis has been proved to be first to depress the reproductive power of the Schistosome and later to kill them. The female of the species was more susceptible than the male. Viable ova rapidly disappeared from the excreta. It has also been observed that the drug exerted/

exerted a direct lethal action on the miracidium.

The Pharmacology and Therapeutics of

A. The Pentavalent Antimonials -

Stibamide (a Pentavalent Antimony preparation).



The dosage: 1-2 mgms. per Kgm body weight. Total

dose - 2-2.2 gms. and route - intravenous.

Technique - 2, 4, 5 and 10 ccs. for 1st 3 days; omit

on 4th day; continue in 10 ccs. on 5th, 6th and 7th

days and beyond if necessary. The use of this drug

may produce fever which, however, ceases on

discontinuing treatment.

B. The Trivalent Antimonial Compounds.

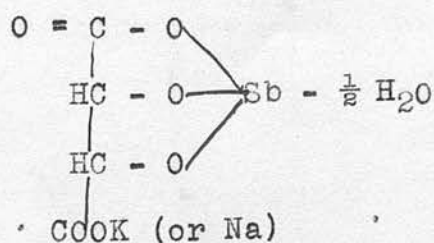
There are five Trivalent Organic Antimony Compounds.

1. Antimony and Potassium Tartrate (tartar emetic).

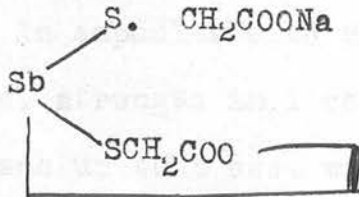
Physical characteristics - a yellow powder, soluble in water.

2. Antimony and Sodium Tartrate B.P. with similar

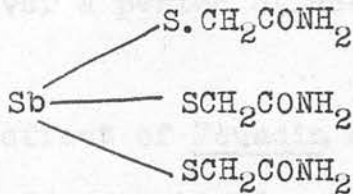
physical characteristics but more soluble in water.



3. Antimony Sodium Thioglycollate N.N.R.- a white to pink colourless powder, very soluble in water and put up in ampoules containing 10 or 20 ccs of a 0.5 cc. solution.

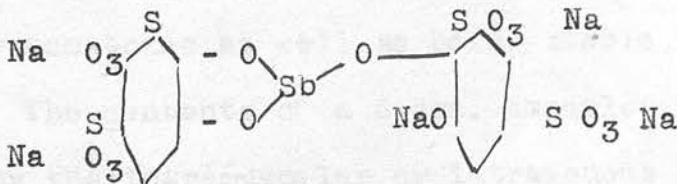


4. Antimony Thioglycollamide N.N.R. - a white crystalline odourless powder, very soluble in water in 1:200. In ampoules containing 10 or 20 ccs. of a 0.4% solution.



5. Fouadin N.N.R. - in ampoules - the amount of Antimony varying from 6.3% (each cc represents 8.5 mgms. of Antimony).

Fouadin Antimony-pyrocatechin-disulphonate of Sodium. "Hypoloid" Stibophen (B.W's Co.)



The therapeutic effects of tartar emetic and Sod. Ant. Tartrate are as follows:-

The accepted maximum single dose of tartar emetic and Sodium Antimonyl Tartrate for an adult is 2 grains. The drug is put up in ampoules with Sodium Chloride of a 1 gr. or 2 grs. strength in 1 cc or 2 ccs ampoules. The injection is made up to 5 ccs. with sterile water with advantage. Intravenous injection is the route used and the dose of 2 grains is repeated not more frequently than on alternate days until a total of 30 grains of the selected drug is reached.. The full course extends over a period of not more than four weeks.

The therapeutic effect of Fouadin also Stibophen (B.W & Co.) introduced in 1929. It is the organic trivalent antimony preparation "Fouadin" or Neo-Antimosan (Sodium Antimony-Pyrocatechin-disulphonate). Fouadin, which contains 13% of Antimony is put up in the form of 6.3% Isotonic sterile solution in ampoules. It is non-irritant and relatively non-toxic as well as being stable in solution. The contents of a 5 ccs. ampoule can be injected by the intramuscular or intravenous route without undue inconvenience to the recipient. Total dosage/



dosage for course of treatment is 40 ccs. given in 9 injections, viz:- 1st 1.5 ccs: 2nd 3.5 ccs: and on 3rd, 5th, 7th, 9th, 11th, 13th, and 15th days 5.0 ccs. each. In children an initial dose of 0.5 ccs. is given rising to 2.0 and 3.0 ccs. and the total dosage for treatment 20.30 ccs.

The therapeutic effect of Anthiomaline - a trivalent Antimonial Anthiomaline, the Lithium salt of Stibiothiomalic Acid. It is very soluble, stable in the dark below 80° C and contains 16% Antimony.



Low toxicity due to the sulphur molecule and clear in solution are other features of this drug. In ampoules of 2 ccs. of 6% solution or 0.01 gms. of Antimony. The dosage is 0.5 ccs. 1st injection to child of 12 years or under; 1.5 ccs. for adults and over 12 years of age, and the principle involved is to give a maximum dose of Antimony (nearly 0.5 gms) in less than a fortnight. The course consists of daily injections (Sundays excluded) of 4 ccs. intramuscularly for 2 weeks. Total dose of Antimony in course 0.46 gms.

All these Antimony drugs are toxic and extremely irritant by nature. The intention is to commence/

commence with a small dose and increase slowly until the maximum dose is reached, when it is repeated for the requisite number of injections. With each injection, toxic side effects may appear, e.g. a feeling of constriction in the chest, spasmodic dry cough, pains (particularly in the shoulders), muscular and abdominal cramps, collapse may occur due to a fall in blood pressure. These toxic effects may be severe and distressing and occur while the solution is actually being introduced. These unpleasant effects may be minimised by ensuring that:-

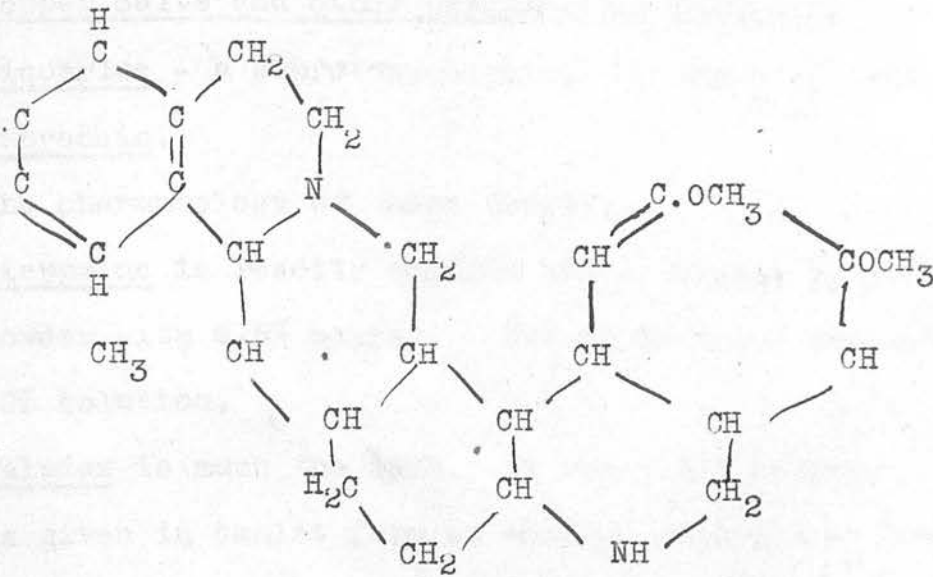
1. The solution of the drug is freshly prepared immediately before use. The drug becomes toxic on standing.
2. The injection is given with the utmost care into the vein without any leakages round the site of injection. Such leakage causes distressingly painful necrosis of the part. Gangrene may also occur.

Note: Tartar Emetic (Potass. Ant. Tartrate) is reputed to be more toxic than Sod. Ant. Tart. Fouadin has a toxic effect on the liver. Anthiomaline is the least toxic of the series.

The administration of a course of tartar emetic lasting some weeks is not to be undertaken lightly.

Emetine/

Emetine is one of the alkaloids of *Epicacuahna* advocated by Tsykalas and others.



It is used in the form of Emetine hydrochloride and put up in ampoules of sterile water in gr I or gr II to 1 cc or 2 ccs ampoules. The dosage used is gr 1½ daily for ten days and given by the intramuscular route (as Emetine HCL 0.02 grs. in grs. 1/3). There are dangers in its use, e.g, risk of the injection being given inadvertently into a vein with disastrous effect.

Emetine is reserved for cases where the intravenous route is impracticable and where the patient has an idiosyncrasy to Antimony. The toxic symptoms of Emetine administration are nausea, vomiting, neuritis, hypotension, tachycardia and cardiac arrhythmias and even death from heart failure.

Drugs used in Treatment of Schistosomiasis with no Antimony base.

Copper Salts and other Oxyquinoline Derivatives.

Dicuprine - a cupro-oxyquinoline sulphate of soda, also Cuprochin.

The pharmacology of these drugs:-

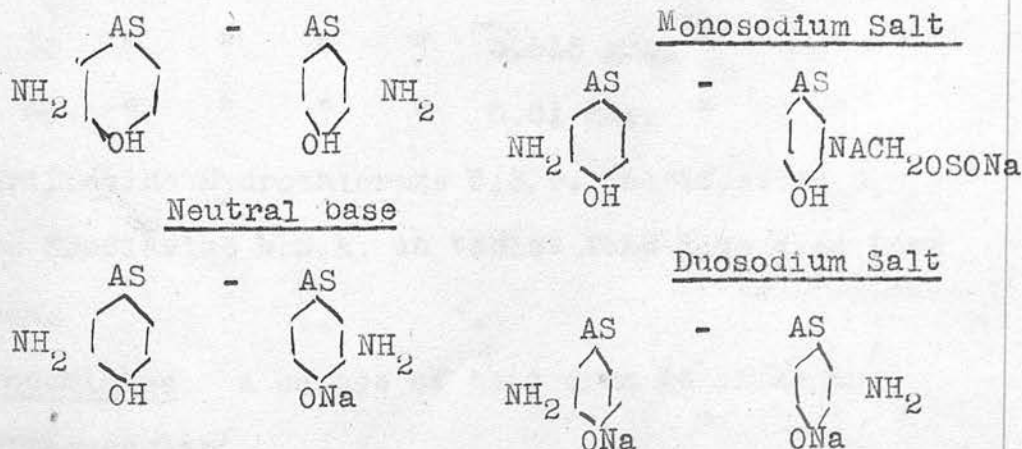
Dicuprine is readily soluble and is a neutral greenish powder with 6.5% copper. Put up in 5ccs. ampoules of 10% solution.

Paludex is much the same. It has 8.37% copper. It is given in tablet form by mouth; each tablet dose 20 mgm.

Cuprochin is also in tablet form containing 0.023 gm copper. The course of treatment for adults is 240 tablets by 18th day or about 4.5 gm of copper. The dosage depends on the body weight.

Bismuth has been used but as it is ineffective against the Schistosome it has no therapeutic value.

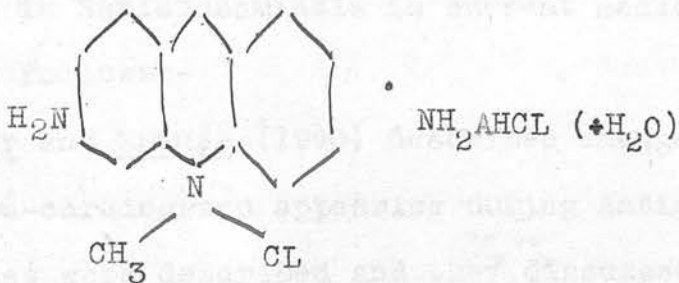
Neoarsinobenzine (N.A.B) Compounds:





These drugs have no lethal effect on the Schistosome. Their use is limited and small doses intravenously are sometimes used for their tonic effect following a course of Antimony.

Acriflavine and Acridine Compounds are derived from Acridine Dyes (Flavines) derivatives of the coal tar base Acridine introduced by Ehrlich in 1912. Now known as Acriflavine.



Their physical characters are brownish red powders, soluble in water.

The dosage depends on body weight and is given either in tablet form 0.1 gm or in ampoules for intravenous injection.

20 Kgms weight or less	0.02 gms. of Acriflavine.
30 " " " "	0.015 gms. " "
60 " " " "	0.01 gms. " "

Acriflavine Hydrochloride U.S. P. (Acriflavine B.P.) and Proflavine N.N.R. in tablet form have also been used.

Propamidine: A course of this drug is given by intramuscular/

intramuscular or intravenous injections. The total dosage varying from 0.6 gms. in children to 1.7 gms. in adults and given at intervals of 4 to 30 days.

Carbon Tetrachloride: The dosage for adults is from 2-3 ccs: for children a dose of 2 minims for each year of age up to 15 years.

Reference to the use of the active therapeutic agents in Schistosomiasis in current medical literature are as follows:-

Mainzer and Krauss (1940) described changes of the electro-cardiograph appearing during Antimony treatment. 12 cases were described and they discussed various E.C.G. abnormalities as well as bradycardia and were of the opinion that intoxication of the heart muscle resulted through therapeutic Antimony administration though the process in most cases was not clinically evident. In exceptional cases the conditions might result in sudden death through auricular fibrillation. Impallomeni (1938) used a "new Antimony preparation", a pentavalent Antimony preparation, in the treatment of Schistosomiasis. He used Stibional B in 20 cases of vesical Schistosomiasis and 1 case of *S. mansoni* infestation. With its use he maintained that haematuria rapidly disappeared, miracidium died, and subjective symptoms improved. The author of this thesis has had no experience of this therapeutic agent.

Reference to the literature revealed the fact that many workers reported on the use of the Trivalent Antimony preparations. A useful survey of Antimonial treatment of Schistosomiasis has been given by Khalil (1935). He maintained that Potassium Antimonium Tartrate (tartar emetic) had these disadvantages:-

They might produce local thrombosis; marked opacity appeared with greatly increased toxicity if boiled till opalescent (probably oxide formed), and increased toxicity unless freshly prepared. Local inflammation in 5% cases. Cough in 10% cases. Nausea and vomiting in 38.8%. Fever, muscular pain in later stage of treatment. Complications seen in its use were herpes and dermatitis. Contra-indications for its use were nephritis, heart failure and fever.

Khalil found that Sodium Antimonium Tartrate was less stable than the Potassium Salt and that Fouadin was much less toxic and more satisfactory results were obtained from its use.

A summary of his cases treated by Fouadin showed the percentage of cures as:-

Year	No of cases	% cured after			% relapse after 1 month
		9 mgs	11 mgs	13 mgs	
1931	3,288	52.25	15.69	3.31	0.71
1932	2,299	62.2	20.5	4.1	9.3
1933	3,302	63.41	15.23	4.38	12.92

Gorsse and Accart (1943) in an article "The Treatment of Urinary Schistosomiasis" stated that N.A.B., Bismuth, and Emetine have proved useless in treatment. Antimony was the only parasiticide - tartar emetic, Fouadin, and Anthiomaline were all effective. Anthiomaline in their opinion was the best of the three drugs. They also stated that Antimony was not a specific for Schistosomiasis like mercury in syphilis; it was insufficient in itself. The desirata in their opinion was a series of parasitical compounds to be given together or in succession.

Cawston (1933) was of the opinion that Potassium Antimonial Tartrate (tartar emetic) was as effective a drug as Emetine and less dangerous in its use by careful regulation and administration of the drug. He stressed the fact that a course should not extend for more than one month.

Cawston (1934) added a plea for treatment sufficient to kill the male Schistosome - the passing of dead ova signified at most death of the female worms, and nothing about the more resistant males. He presumed the male was still present in cases where symptoms failed to improve. Potassium Antimonyl Tartrate/



Tartrate again advocated in a month's long course repeated if necessary after an interval. Cawston (1934) made mention of the fact that when Antimony Potass. Tartrate was first introduced for intravenous injection it contained lead and other impurities. Consequent ill effects were attributed to the drug itself and it fell into disuse. The Sodium Salt and Fouadin, its sodium equivalent were largely substituted though at the S. African Institute for Veterinary Research, the Potassium Salts and Antimosan, its potassium equivalent, were retained. He still maintained that tartar emetic was the drug of choice and that the Sodium Antimonyl Tartrate was a more toxic agent than tartar emetic. Cawston (March 1937) recorded using a total dose of 20-25 grs. tartar emetic and Sod. Chloride, the injections being given on alternate days. A filtered and then sterilised solution of tablets or powder of tartar emetic and sodium chloride was less likely to give rise to coughing on intravenous injection than in an unfiltered one. Christopherson and Ward (1934) in England advised using Sodium Antimony Tartrate in doses of gr. 2 in 4 days by daily administration and thereafter to give grs.  $2\frac{1}{2}$  on alternate days so that a total/

that a total of 28-30 grains may be reached in 3-4 weeks. The intention was to avoid flukes becoming "drug fast". Gopsill (1937) had found Sodium Antimony Tartrate intravenously proved more effective than any of the more modern remedies. Greig (1940) referred to the resistance of Schistosomes to Antimony Tartrate (both Potassium and Sodium). He used Fouadin on a case instead of tartar emetic or Sodium Antimonyl Tartrate. Khalil (1936) mentioned the individual variation in the excretion of drugs as an important factor in their therapeutic results- a practical method for detecting the Schistosomiasis cases with so-called idiosyncracies to Antimony to avoid fatalities and complications was described. Fahkry (1934) made mention of the toxic effects from administration of Antimony drugs in reporting a case treated for Antimony dermatitis with Sodium Thiosulphate and a case of collapse following the administration of tartar emetic.

The author of this thesis has found Sodium Antimonyl Tartrate more effective than tartar emetic (the Potassium Salt), and it has appeared to be less toxic.

The toxic/

The toxic effects of these drugs which have produced pain in the shoulders might have some relationship to the high altitude, a hypothesis put forward by Cawston (1934) of S. Africa, and which the author has observed in S. Rhodesia.

He, the author, has been convinced of certain well defined disadvantages:-

(a) The length of time to complete the course of treatment - the patient has tired, he has failed to co-operate, or has defaulted during the course. This has caused a resistance of the Schistosomes to the drug and relapses after treatment occur.

(b) The difficulty of spacing injections to alternate days when dealing with patients engaged on transportation services, e.g. railwaymen. Also farmers and miners living many miles from their practitioners. The inevitable result has been for the course of treatment to extend to nearer 4 weeks and even 5 weeks in some cases.

(c) The expense of a long course of treatment and the economic factors involved.

The resistance of the Schistosomes to Antimony have appeared to be due to a physiological cause - a too rapid/

a too rapid excretion of the drug by the kidneys, and a therapeutic one - the course of injections having been given over too long a period. In the author's experience relapse rates after treatment by Sodium Antimonyl Tartrate and tartar emetic have varied from 10-15% over a period of 3-6 months from termination of treatment - in this regard the possibility of re-infestation during the interim must be borne in mind.

FOUADIN:

Cawston (1936) stated that "The introduction of remedies (Fouadin and others), which can be administered with less skill has resulted in many cases being treated without due regard to the condition of the escaping ova and the Eosinophil Count. Until the investigation is carried out on an adequate number of cases it is impossible to determine what total dosage of the less irritating compounds is necessary or whether certain cases may prove to be less responsive to treatment in this way". Cawston (1933) noted that colloidal properties of Antimony "Fouadin" have proved uncertain vermicides and that they might produce late vomiting and hepatic disturbances. Cawston (1936) observed that Fouadin with/



Fouadin with its inferior Antimony content cannot be recommended unless the intravenous route was impossible or where treatment might be repeated if found necessary. Cawston (1940) found difficulty in giving adequate doses of Antimony in the form of Fouadin owing to the toxic action of its pyrocatechin radicle. Gopsill (1931) stated that "cure was more rapid with 6 intramuscular injections of Fouadin on alternate days rising from 1 cc to 4 ccs. than with tartar emetic or Emetine". Orenstein (1934) referred to the alleged dangers of the administration of Fouadin and made reference to Cawston's observation that there was a risk of hepatic damage in its use. Orenstein did not find one case of liver damage in 300 school children treated and in his opinion "Fouadin is approximately as efficacious as the Sodium Antimonyl Tartrate drug provided it is given in proper dosage". Khalil (1935) in a survey of Antimony Treatment of Schistosomiasis gave a summary of cases treated with Fouadin in the years 1931, 32 and 33. Van Nitsen (1934) used concentrated Fouadin in the treatment of intestinal Bilharziasis. A calcium salt was used instead of a sodium one as in ordinary Fouadin which gave 14.3 mgm. of available Antimony Compound against the 8.5 mgms. per 1 cc. of ordinary Fouadin. He treated/

He treated 13 cases (injections given at 24 hour intervals in series of 1st injection 1 cc, then 2 ccs. thereafter 3 ccs) with good result. Medulla (1935) reported one case of apparent cure of vesical Schistosomiasis treated with Fouadin and Lee and Chung (1935) found that Schistosoma Japonicum was more rapidly cured with tartar emetic than with Fouadin.

In the Annual Report of Department Public Health, year ending 30 June '36, Union of S. Africa, it was stated that in 3 treatment campaigns Fouadin was preferred to other drugs for convenience of handling. It was claimed to cure if care and common sense were used. Greig (1940) described a case of Schistosomiasis resistant to Antimony Tartrate which responded satisfactorily to treatment by intramuscular Fouadin - total dose of 40 ccs. in 15 days was given. Goodwin and Page (1943) reported on the fate of Stibophen in the body. Fahkry (1934) reported a case of Antimony Dermatitis following administration of Fouadin, and Cawston (1940) met cases of liver damage and other abdominal toxic effects (cramps) through its use. Ockuly (1945) treated a case of active Schistosomiasis and claimed a cure with Fouadin.

The author/

The author of this treatise used Fouadin while in practice in Bulawayo in 1937 - his cases were mainly children and the results obtained were not outstanding from the point of view of cure. No toxic effects in its use were, however, observed. Further in regard to Fouadin the author refers to Cawston (1937) who stated "The efficiency of the drug employed for treating this infection (Schistosomiasis) would seem to depend very largely upon its Antimony content. The vast majority of persons treated by Fouadin are incompletely cured of Bilharzial infection in S. Africa and due consideration has not been paid to the fact that this easily applied compound contains only 13.5% Antimony metal instead of 36.46% in tartar emetic. To reach over 0.5 gm of Antimony metal about 60 ccs Fouadin are required". Clayton-Lane (1934) summarised:- "This conclusion reached by investigating the proportion of metal in Antimony derivatives has been borne out by clinical experience".

He, the author, has shown conclusively that the Antimony content is the all important point in the use of a drug against the Schistosome. Fouadin is at a/

is at a disadvantage here as compared with tartar emetic and Sodium Antimonyl Tartrate. Adequate dosage is essential to promote satisfactory cure and in adults 60 ccs. maximum is certainly advised with corresponding lower doses for the younger patient and child. It is easier to administer and gives little pain or discomfort. For this reason it has been preferred to tartar emetic and Sod. Ant. Tart. in the case of children and in adults with poorly developed venous systems. Toxic effects of Fouadin administration have been observed. In cases who show pathological lesions, e.g. peptic ulcer, hepatic disease and gall bladder disease, Fouadin should not be the drug of choice.

Anthiomaline - Reference to its use in medical literature is as follows:-

Richet (1936) found in treating his own case that Anthiomaline was the most effective remedy he used.

"A chronic infection needs chronic treatment and Antimony, while not strictly specific as the most active agent, Fouadin and Anthiomaline being the most efficacious". Cawtson (1936) stated that the Lithium salt of Antimony was less toxic than Sodium Antimonyl Tartrate and was deserving of use. A preparation that was put up conveniently for use.

Moulinard/



Moulinard (1936) maintained that Anthiomaline was a better drug against Schistosomiasis than Emetine or tartar emetic. He treated eight cases with each drug, the material was 24 boys of 12-14 years.

Emetine	daily doses	0.04 and 0.6 mgm.
Tartar emetic	" "	0.108 and 1.2 gr.
Anthiomaline	" "	0.106 and 1.38 gr.

Mean cure % at end of treatment and some months later were judged by absence of ova in urine and stool.

Emetine	62.5% and 12.5%	(some months later)
Tartar emetic	75% and 25%	" " "
Anthiomaline	100% and 85.7%	" " "

He found that Anthiomaline injections caused no painful and no local or general reaction and no evidence of renal damage was observed in his cases.

Gobert, Farges and other co-workers (1937) all claimed to have cured cases of Schistosomiasis with Anthiomaline. Ashkar (1938) treated 24 cases of urinary Schistosomiasis with intramuscular Anthiomaline in a 6% solution. Mills (1945) mentioned using Anthiomaline in 46 cases with satisfactory results and that treatment was dependent on pushing the amount of Antimony to almost toxic limits to get the best results. Its action and effect was intensified when combined with Stibophen B (Fouadin) and the percentage of cure was high.

The author has used Anthiomaline since 1938 and has found it a safe, non-toxic drug, which gave good results if adequate dosage was administered.

The use of Copper Salts in the treatment of Schistosomiasis has been referred to by Van Nitsen (1937). He used two copper organic compounds, Dicuprine and Paluden, on 150 native cases of *S. mansoni* infestation. Cawston (1936) considered that the oxyquinoline derivatives were of great assistance in curing Schistosomiasis and he advised their application to districts where a large proportion of the inhabitants could not afford the usual cost of prolonged treatment. He also mentioned treating two cases unsuccessfully by oral tablets of Cuprochin in 1938.

The author of this thesis has had no experience in the use of these drugs and in S. Rhodesia they have not been used to any extent. From the available information the efficacy of copper salts as effective therapeutic agents against the Schistosome has not been fully established.

#### Acridine and Acridine Compounds.

Khalil (1934) and El Diwany (1934) reported the use of these agents in treatment of Schistosomiasis and in Ankylostomiasis infestations with no definite conclusions as to their efficacy. Fischer (1934) in treating 52 cases of intestinal Schistosomiasis in the Belgian/

Belgian Congo, obtained promising results. Fahkry (July 1934) in a preliminary note, suggested that acriflavine was useless against Schistosomes but valuable against Ankylostomiasis. In the author's opinion there is insufficient evidence to assess the real merits of this active agent in the treatment of Schistosomiasis.

Stilbamidine;

Stephenson (1945) and Kirk (1945) have reported on the use of Stilbamide and the conclusions they drew were that the action of this drug was too uncertain to justify its routine use in urinary Schistosomiasis.

Propamidine;

Cawston (1944) tried it in a few cases of urinary Schistosomiasis but he found it was much more useful in staphylococcal infections of the skin and nasal cavities.

Other Methods of applying the active therapeutic agent against Schistosomiasis.

The ideal requirements in drug therapy are for a drug to be lethal to both male and female Schistosome and not highly toxic to the host; the course of the treatment to be short, and the treatment itself inexpensive. The avoidance of relapses is also important.

Intensifying the course of treatment (a) by higher concentrations of the drug and (b) by using shorter intervals of the actual and usual course of treatment has been attempted, i.e. intensive treatment by an active therapeutic agent.

This idea of combining a course of treatment with one or two drugs to obtain a synergistic or "boosting" action has been attempted and reference to the medical literature reveals the fact that:-  
Khalil (1936) stressed the advantage of an intensive treatment in a short time to avoid resistance of the Schistosome (especially the male) to the drug. To date none of the Antimony series of drugs has met all these requirements and the endeavour of some research workers has been to evolve a more effective method of applying these known drugs.

Mills/



Mills (1945) combined the use of Anthiomaline and Stibophen with very good effect. Cawston (1934), however, stated that the effect of tartar emetic became less effective if an insufficient course of Fouadin had already been given. This hypothesis has not been substantiated by others.

Van Nitsen (1934) treated intestinal Schistosomiasis by a concentrated Fouadin with promising results.

Cawston (1936) used comparatively large doses of tartar emetic given to children without ill effects, the treatment being given in 3-4 weeks. Christopherson and Ward (1934) in England advised using Sodium Antimony Tartrate in doses gr li in 4 days by daily administration and thereafter to give grs liii on alternate days so that a total of grs. 28-30 might be reached in 3-4 weeks. Mills (Jan 1936) more recently described the treatment of 46 cases of infestation with *S. haematobium* with both Anthiomaline and Stibophen given in larger concentrated doses over shorter periods of time - from 4 weeks to 2 weeks.

Alves (1945) gave a preliminary note reporting the successful treatment of a few cases of Schistosomiasis with full/

with full doses of Sod. Ant. Tart. frequently repeated within a period of only 2 days. Alves and Blair (1946) recorded in detail the treatment of 100 cases of *S. haematobium* and *S. mansoni* infections in S. Rhodesia.

The Lancet Editorial (Jan. 1946) commented as follows:

"Their (Alves and Blair) results of:- Therapeutic results being excellent, the absence of toxic side-effects with a proper technique of injection, the dramatic shortening of the period necessary for adequate curative treatment with its great benefit to the patient and doctor alike, together with the fact that economically this treatment had a great advantage over the previously tried methods". Alves

and Blair (1946) mentioned in their historical introduction to their series that:-

Intensive Antimony therapy, like Intensive Arsenic therapy was based on the work of Chargin and his colleagues (1935) who demonstrated that drugs rapidly injected intra-muscularly might give rise to what they called "speed shock". They were on the other hand able to introduce comparatively large amounts of substances as toxic as histamine without difficulty if not more 2-3 cm. per minute was injected. They then applied these findings to the treatment of syphilis/

syphilis with large doses of Arsenic preparations (Hyman et Al 1939) using an intravenous drip transfusion technique. Eagle and Hogan (quoted by Cole et Al 1943) on rabbit syphilis showed that multiple syringe injections were more effective in cure than the continuous drip technique. Their term "multiple syringe injections" implied four intravenous injections daily. Alves (1945) tried a "continuous drip" with a solution of 5% glucose saline containing gr I of Sod. Antimony Tartrate per 100 ccs. in one case. Excruciating phlebaigia resulted from the treatment. Therefore all their subsequent cases have been treated by a "multiple syringe injection technique".

The author, from his own experience, has formed the following opinions on Active Biharzial Therapy.

The trivalent Antimony drugs have proved the most reliable in destroying the male and female Schistosomes under certain conditions. The pentavalent Antimony compounds have proved useless in this respect with one exception (Stibional B) and work on this drug has been insufficient to judge its real efficacy. The trivalent Antimony compounds have in fact been the basic metals on which the therapeutics of Schistosomiasis have been based for 30 years.

Pottassium/

Potassium Antimony Tartrate (tartar emetic) and Sodium Antimony Tartrate are equally effective as a Schistosomicide. There has been a marked diversity of opinion as to which of these two has proved the more effective in actual practice.

The remaining three compounds in this group which have an organic antimony base have been used for the past 15 years.

Fouadin has had its enthusiastic supporters. Anthiomaline, the Lithium Salt of Antimony, has proved an equally satisfactory substitute for the other preparations. Its introduction and use has been an advance on Fouadin, by virtue of its higher Antimony content. The other reputed specific drugs have been discussed in detail but none of them has approached and certainly not superceded the effectiveness of the trivalent Antimony compounds.

Finally, the newer methods of technique in the application of the drugs and particularly that of Sodium Antimonyl Tartrate have been described. This method of therapeutic treatment certainly appears to be a decided advance on the older methods that have been practised.



The Tests of Cure of Schistosomiasis have an important bearing on a review of the disease in determining whether or no an actual case of Schistosomiasis treated, has in fact been cured of the infesting Schistosome.

The tests available are:-

1. Cessation of all clinical features of the disease - absence of signs and symptoms.
2. Disappearance of active ova in stools and urine immediately after treatment and at a 3 months follow-up period.

In this respect Cawston (1934) in evidence of the successful destruction of Schistosomes stated that absence of ova did not imply absence of a cure of Schistosome infestation. The persistence of male parasites after treatment which have killed the females does in fact occur.

The likelihood of missing ova at microscopic examination of the patient's excreta must be kept in mind, while the probability of a slow development of the female Schistosome has also to be considered.

3. Cercarial Skin Test Antigen - negative.

Complement Fixation and/or Reaction (Fairley) - negative.

4. Euphoric/

4. Euphoric effect (subjective) together with a gain in weight.
5. Normal Blood Sedimentation Rate.
6. Normal Eosinophil Count and normal white blood count (to exclude any complicating septic condition).
7. Cystoscopy in all vesical cases and in unsuspected undiagnosed cases.

Various workers, notably Campbell-Begg (1942) Mills (1946) and Vermooten (1940) all stressed the desirability of this measure as a method of determining cure following treatment.

8. Sigmoidoscopy in all cases of intestinal Schistosomiasis diagnosed or undiagnosed.

In conclusion, a case under review has to satisfy all these tests of cure before the medical practitioner has justification in pronouncing a complete recovery and cure.

The Author's own cases and observations.

A. (1) 25 European cases treated by Intensive Treatment with Antimony.

The author treated twenty-five European cases by Intensive Sodium Antimonyl Tartrate between Sept. and Dec. 1945, using a Multiple Syringe Injection Technique. The material used for these experiments was the European subject - child, adolescent, and adult of both sexes. In the series of 25 cases, 12 men, 7 women and 6 children were included. In view of certain information regarding the new technique of treatment that had been published by the Rhodesian press in September 1945, no difficulty was experienced in obtaining the necessary material for treatment. The patients were most enthusiastic to undergo the new form of treatment and no persuasion, certainly not compulsion, was resorted to by the author to convince them of the benefit likely to accrue from such a method. The prospect of completing the treatment in a matter of hours rather than days, despite hospitalisation and a few unpleasant reactions that might arise, appealed to the patients.

The cases/

The cases were suffering from both vesical (*S. haematobium*) Schistosomiasis and intestinal (*S. mansoni*) Schistosomiasis. A few cases in the series had no demonstrable ova in urine or stool. The cases were selected in that a careful history and clinical examination was carried out initially and no patient was subjected to the treatment until the author was satisfied that there was no serious pathological lesion of the heart, lungs, hepatic or renal systems. The circulatory system was examined carefully to determine any cardiac impairment. It had been the author's intention to have an Electrocardiograph performed on each case before treatment was commenced and again after completion of the course, but for reasons of economy (war, expenditure, etc,) this could not be done.

The diagnosis was made by the usual methods already described and particular note was given to the reading of the Cercarial Skin Test Antigen and the Eosinophil Counts in all cases. A positive + Skin Test Antigen Reaction was not confirmed in all the cases by the finding of viable ova in the urine and stool/



stool, (vide diagnosis tables, pages 119 ), but a Presumptive Diagnosis of Schistosomiasis in these cases by a careful analysis and interpretation of the history, clinical signs and symptoms, the Cercarial Skin Test Antigen, and the Eosinophil Percentage Count in each case, guided the author to make a justifiable decision.

The 25 cases subjected to the Intensive Treatment with Antimony were admitted to hospital and patients' weights, (in lbs) were checked again on admission. The number of cases treated and under review were smaller than intended but the shortage of beds in the hospitals (The Government Hospital and St. Anne's Hospital in Salisbury), brought about by six years of war and the immediate post-war transition period curtailed the author's plans in this respect.

Details of the history and examination of the cases treated by the Multiple Syringe Technique were as follows:-

Case No:

1. S. (J.), aged 19 years, male, (private case), occupation - apprentice Municipal (Abattoir) employee.

Complained/

Complained of terminal haematuria at intervals of a few days. Increasing lack of energy over a period of months. No history of loss of weight, pyrexia, or urticaria, and no constipation. Duration of symptoms was four months.

Previous History: Always healthy; very athletic type at school and no serious illnesses and no operations. Malaria, mild attacks, on two occasions. No previous history of Schistosomiasis, but risk of infestation during the years 1940-45 at school at Plumtree. All previous tests of Bilharziasis negative.

Examination revealed - healthy appearance; good physique and musculature, and all systems organically sound.

2. M. (H.E.), aged 55 years, male (private case), occupation - business manager.

Complained of loss of weight and appetite, tired on awakening each morning. Pruritus ani and blood and mucus on occasions in stool. Duration of symptoms 6 months.

Previous History: In 1936 had intestinal Schistosomiasis (*S. mansoni*). Full course of S.A.T. gr 30, given at that time. In 1939 while at London, went through a test of cure at the London School of Tropical Medicine/

Tropical Medicine and Hygiene and was given a clean bill of health. Symptoms in 1936 were similar to those now complained of with exception of constipation and no loss of weight. Has had malaria on four occasions during a 30 years residence in S. Rhodesia. Risk of re-infection since 1939 probable as shooting a regular hobby, particularly wild duck in season, i.e. in the dry season.

Examination revealed - sallow complexion; no obvious loss of weight; all systems organically sound.

3. A. (Mrs.), aged 19 years, female - married (private case), occupation - housewife.

Complaining of loss of weight (has lost 16 lbs in last 9 months), increasing debility and lack of energy; also backache of pre-menstrual type and menorrhagia. No other symptoms or signs referable to the renal or intestinal systems.

The menstrual history - menarche 15 yrs. Menstrual habit and type normal, but backache and menorrhagia.

Married 2 $\frac{1}{2}$  years. Para 1, <sup>0</sup> + 14 months. Had operation (dilatation and curettage) September 1945. Duration of ill-health - 9 months.

Previous History: No history of Schistosomiasis but had run the risk of infestation over a number of years - a keen swimmer and favoured rivers. Always enjoyed/

enjoyed good health and no serious illnesses apart from malaria.

Examination revealed - marked pallor and obvious loss of weight; hypochromic, macrocytic, anaemia present. Haemoglobin 55%, R.B.C. 4,360,000. All systems appeared organically sound.

4. W. (J.M.), aged 34 years, male (private case), occupation - City water engineer.

Complained of loss of weight and no energy. Appetite poor but no gastric or renal history given. Duration of symptoms - 6 months.

Previous History: always fit and healthy and active.

Nil except history of malaria - 2 mild attacks - last attack 1924. No previous history of Schistosomiasis, but risk of infestation for 8 years in view of his occupation.

Examination revealed - healthy appearance, well-developed musculature and good physique. All systems organically sound.

5. K. (S.L.), aged 18 years, male (Railway employee), occupation - fireman.

Complained of loss of appetite; loss of weight; debility; gastric pains and backache; no urinary symptoms and no constipation or blood and mucus in stools. Duration of symptoms - 6-9 months.

Previous History:



Previous History: Good health till 1944 and nil except from malaria attacks. Appendicectomy May 1944 for subacute appendicitis. Patient's symptoms were partly due to his occupation as he had no interest in his railway grade. No previous history of Schistosomiasis, but definite occupational risk of infestation for 2 years.

Examination revealed - healthy appearance; good physique; no obvious anaemia. All systems organically sound. No splenomegaly.

6. G. (E.M.), aged 31 years, female (married), occupation - nurse (S.R.N.) in doctor's surgery. Complained of gastric symptoms, and attacks of pain in R.I.F. off and on for years, acidity, loss of weight, and sterility. Duration of symptoms - 6 years.

Previous History: always healthy till 1933 when, while a probationer nurse, she had diphtheria.

Appetite good. Bowels regular and no history of malaria.

The menstrual history - menarche 13 years. Menstrual habit and type normal. Dysmenorrhoea - pre-menstrual type. Absolute sterility for 5 years. No previous history of Schistosomiasis, but definite risk of infestation from 1930-35 bathing in rivers.

Examination/

Examination revealed - very healthy appearance, good colour and no obvious anaemia. All systems appeared organically sound, but tenderness on deep pressure over McBurney's point elicited.

7. W. (Mrs. M), aged 31 years, female (married), occupation - nurse and housewife.

Complained of urinary symptoms; pain and frequency; backache; increasing debility; lack of energy and loss of weight. Was treated for cystitis and right sided pyelitis in 1937 with relapses in 1939 and 1944. Responded to course of massive Pot. Citrate, and Mandelic Acid therapy. In 1944 had 5-day course of 30 gms. sulphapyridine and urinary antiseptics (Hexamine, etc) with effect. In September 1945 recurrence of symptoms and urine examination revealed pus cells ++. Duration of symptoms 6-7 years.

Previous History: always enjoyed excellent health until 1938. No serious illnesses apart from malaria.

Menstrual history - menarche 14 years; menstrual habit and type normal, but dysmenorrhoea and backache, considerably worse since 1938. Married 6 years.

Absolute sterility 18 months. No previous history of Schistosomiasis, but definite risk of infestation bathing in rivers up till 1937-38.

Examination/

Examination revealed toxic appearance, under weight and anaemic. Blood pressure 110/60. R.B.C. 4,300,000, haemoglobin 53%. Central Nervous System - reflexes hyperactive; tenderness on pressure over right lumbar region. Other systems appeared organically sound.

8. H. (C.M.), aged 15 years, male (Railway dependent), schoolboy.

Complained of loss of weight, gastric symptoms (vague) with loss of appetite and tendency to constipation and progressive debility, no energy. School reports poor during 1945. Duration of symptoms - 6 months.

Previous History: subject to bronchitis and asthma since infancy. No attack since 1942. Otherwise nil and no malaria history. Previous history of Schistosomiasis (*S. mansoni*) in 1940 given. Two courses of Anthiomaline were given in 1940 and test of cure (absence of active ova in stool), and normal Eosinophil Count obtained. Subsequent risk of infestation unlikely. ? relapse case.

Examination revealed - healthy appearance, good adolescent physique, no anaemia, all systems organically sound.

9. P. (E.), aged 18½ years, female (private case), occupation - photographic assistant.

Complained/

Complained of loss of weight, vague gastric symptoms, constipation, loss of energy and debility. Duration of symptoms - 6 months.

Previous History - healthy and nil apart from attacks of malaria. Previous history of Schistosomiasis given. In 1940 had active S. mansoni infection and course of S.A.T. intravenously given with apparent cure. Risk of infestation since unlikely. ? relapse case.

The menstrual history - menarche 13½ years. Menstrual habit and type normal.

Examination revealed - healthy appearance, but under weight; all systems appeared organically sound.

10. G. (J.), aged 17 years, male (private case) schoolboy.

Complained of vague symptoms - lack of physical development and some debility and loss of energy. Duration of symptoms - 2 years.

Previous History: always healthy and nil apart from malaria - two attacks, last one mild 1940. No previous history of Schistosomiasis, and only one definite risk of infestation 2 years ago when he bathed in a river in Ft. Victoria District.

Examination /



Examination revealed - fit and healthy appearance; under weight and height for age. All systems appeared organically sound.

11. C. (S.), aged 41 years, male (private case), occupation - Gov. surveyor.

Complained of lack of energy, irritability and nervy, no urinary symptoms and apart from some anorexia no other gastric symptoms. Duration of symptoms - 3 months.

Previous History: enjoyed good health apart from attacks of malaria. Has had a catarrhal obstructive (bilateral) deafness due to scarlet fever in Scotland 35 years ago. No previous history of Schistosomiasis, but patient had run a definite risk of infestation during the past 20 years in the course of his occupation and by swimming in rivers in S. Rhodesia.

Examination revealed - healthy appearance, good physique and musculature, all systems organically sound. No splenomegaly.

12. P. (F.), aged 38 years, male (Railway employee), occupation - fitter.

Complained of urinary symptoms of burning at point of penis; no haematuria but supra-pubic discomfort; also feeling of malaise, slight loss of weight, weakness/

weakness and debility. No history of urticaria or pyrexia. Duration of symptoms - 2 months.

Previous History: always enjoyed good health; athletic; no serious illnesses apart from malaria.

No previous history of Schistosomiasis, and only real risk of infestation has been an occupational one.

Examination revealed - healthy appearance, athletic muscular build, no anorexia and no obvious loss of weight. All systems appeared organically sound.

13. C. (I.), aged 15 years, male (private case), schoolboy.

Complained of loss of weight, listless, irritable and no energy; position in school class poor which was unusual. Duration of symptoms - 4 months.

Previous history: always been a healthy boy, good at school, academically and athletically. Nil apart from attacks of malaria. Previous history of Schistosomiasis given, intestinal Schistosomiasis, (*S. mansoni*), in February 1945. Course of Sod. Ant. Tart. (grs 24) given with apparent cure and clinical improvement. Unlikely risk of infestation since that date. ? relapse case.

Examination revealed - healthy appearance, no anaemia, good musculature, all systems appeared organically sound.

14. T. (H.J.)/

14. T. (H.J.), aged 24 years, male (Railway employee), occupation - fireman.

Complained of loss of weight, headache, malaise and progressive lack of energy. No renal or gastric symptoms or signs. Duration of symptoms - loss of weight 3 months, no energy 7 months.

Previous History: always has enjoyed good health and no serious illnesses apart from malaria. Has a stammering speech. No previous history of Schistosomiasis, but risk of infestation by bathing up to 1937 and since then occupational risk.

Examination revealed - healthy appearance, no anaemia and all systems appeared organically sound.

15. S. (B.), aged 18 years; male (private case), occupation - clerk.

Complained of vague attacks of abdominal colic with loss of weight, loss of appetite, and lack of energy.

No history of urinary or other renal symptoms.

Duration of symptoms - 12 months.

Previous History: always enjoyed good health. In October 1945 had acute attack of appendicitis and emergency appendicectomy. An unsuspected Schistosomiasis infestation was diagnosed at that time. No previous history of Schistosomiasis infestation and patient unaware of the disease. Tests at school/

at school during previous five years all had been negative. Definite risk of infestation given - bathing in rivers near Salisbury for 5-8 years. Examination revealed a healthy young adolescent; good physique and musculature. No anaemia, no obvious loss of weight; all systems appeared organically sound. The patient has had an impediment in speech (a stammer) for some years.

16. R. (Mrs. E.), aged 35 years, female (married), housewife.

Complained of loss of weight, debility, gastric pains and menstrual disturbances with sterility. Duration of symptoms - 3 years.

Previous History: has had frequent bad attacks of malaria and one attack of Black Water Fever in 1941. Ill health was attributed to these factors largely. Repeated examinations of stool and urine gave negative reports. Lives in an unhealthy part of Miami-Sinoia District, N.W. of Salisbury. No previous history of Schistosomiasis, but a definite risk of infestation during past 6 years.

The menstrual history - menstruation regular habit and type, but menorrhagia severe and history of 5 years absolute sterility with a doubtful one miscarriage at 6 weeks in 1939.

Examination revealed sallow complexion and obvious loss of weight. No marked degree of anaemia and all systems appeared organically sound.



17. H. (J.F.), aged 32 years, male (private case) occupation - municipal employee (abbatoir).

Complained of irritability, loss of weight, debility, no gastric or renal history, increasing debility and loss of energy. Duration of symptoms - 12 months.

Previous History: At age of 13 years patient had a head injury and has been subject to epileptiform seizures since that date. Otherwise, nil apart from malaria on occasion. No previous history of Schistosomiasis, but risk of infestation by bathing over a number of years.

Examination revealed - healthy appearance, good musculature, all systems appeared organically sound. Central Nervous System - reflexes were found to be normal in all respects.

18. F. (E.D.), aged 9 years, male (private case), schoolboy.

Complained of debility, listless, anorexia and vague renal symptoms, but no history of haematuria, fever, malaise or urticaria. School work had deteriorated. Normally very bright and intelligent. Duration of symptoms - 6 months.

Previous History: Always been a healthy child and nil apart from one attack of malaria and one of broncho-pneumonia in 1941. No previous history of Schistosomiasis/

Schistosomiasis, but risk of infestation likely in rivers near residence.

Examination revealed - healthy appearance, no marked anaemia, all systems appeared organically sound.

19. O, (D.), aged 13 years, male (Railway dependent), schoolboy.

Complained of loss of weight, anaemia, no energy, listless, and school work definitely had deteriorated. Duration of symptoms - 6-12 months.

Previous History: A fit boy till three years ago when at Umtali, Ankylostomiasis was diagnosed and a course of Carbon Tetrachloride treatment given with benefit. He had never been really fit since. Was subject to attacks of malaria. In August '45 he was admitted to hospital for further Carbon Tetrachloride treatment for hook worm infestation (at that time no active Schistosomiasis ova were found). No previous history of Schistosomiasis, but risk of infestation in rivers at Umtali 1940-45.

Examination revealed a pale, anaemic youth, under weight for age. Poor physical development. All systems, however, were found to be organically sound.

20. M. (Mrs. R), aged 25 years, female (married), private case; housewife.

Complained of loss of weight, gastric symptoms of indigestion, abdominal discomfort and tendency to constipation/

constipation; no energy. Duration of symptoms - 6 months.

Previous History: Had always enjoyed good health and nil apart from malaria. No previous history of Schistosomiasis, but definite risk bathing in rivers. Tests have always proved negative.

Menstrual history - menarche 15 years; menstrual habit and type normal; para 3, and 1 miscarriage at 3 months in 1944.

Examination revealed a healthy subject; no anaemia; no loss of weight; all systems appeared organically sound.

21. K, (P.O.J), aged 18 years, male (Railway employee), occupation - fireman.

Complained of urinary symptoms and signs; terminal haematuria; backache; loss of weight and gastric symptoms with right sided appendicular colic.

Duration of symptoms - 6 months.

Previous History: Nil apart from malaria. No previous history of Schistosomiasis, but risk of infestation in rivers and occupation. Tests have always been negative.

Examination revealed - healthy appearance; no anaemia; and all systems appeared organically sound.

22. A. (A.)/

22. A. (A.), aged 12 years. male (private case), schoolboy.

Complained of - lethargy; loss of weight; listless; schoolwork deteriorated. No definite renal or gastric history given. Duration of symptoms - 12 months.

Previous history: Always a healthy child, one mild attack of malaria. No previous history of

Schistosomiasis, but risk of infestation in rivers near Salisbury over a period of years.

Examination revealed good physique; no obvious loss of weight; all systems organically sound.

23. S. (M.), aged 2 years; female - married - (private case), housewife.

Complained of vague abdominal pains right iliac fossa - intermittent attacks with indigestion and flatulence. Differential diagnosis from appendicular colic, renal colic, duodenal ulcer and gall-bladder disease.

Sudden acute exacerbation end July 1945 and emergency operation for appendicitis when macroscopically the presence of pseudo-Bilharzial tubercles were found.

In view of the case history and a feeling of increasing debility and lack of energy the case was investigated further. Duration of symptoms - 12 months.

Previous History/



Previous History: Menstruation regular habit and type.

Married 2 years. Para 1 <sup>0</sup> + 10 months. No previous history of Schistosomiasis, but definite risk as girl at Enkeldoorn. Brother had Bilharzial infestation and died of a ruptured appendix in 1934.

Menstrual history - menarché 13 years; menstrual habit and type normal. Para 1.

Examination revealed healthy appearance inclining to adiposity. No anaemia and all systems organically sound.

24. P. (P.A.), aged 33 years, male (private case), occupation - plumber.

Complained of persistent backache; loss of weight; anorexia; increasing degree of listlessness and debility. Pain in right lumbar and right inguinal regions. No other urinary or renal symptoms.

Duration of symptoms - 18 months.

Previous History: Always enjoyed good health till 3 years ago apart from malaria in Gatooma District 1930-38. Symptoms worsened during 1940-45 when patient was an active member of 1st Batt. The Rhodesian Regiment. No previous history of Schistosomiasis, but definite risk of infection up to 1938 swimming in rivers near Gatooma.

Examination/

Examination revealed healthy appearance; good physique and musculature; all systems appeared organically sound.

25. L. (A.), aged 39 years; male (private case); occupation - small worker (gold).

Complained of urinary symptoms of burning micturition but no haematuria; loss of weight; debility; listless; no pyrexia or urticaria. Duration of symptoms - 12 months.

Previous History: Always fit and nil apart from malaria. Had repeated tests of urine and stool performed before 1945 but all proved negative. No previous history of Schistosomiasis, but risk of infestation likely in view of occupation.

Examination revealed no physical signs of disease, and all systems were organically sound. Cystoscopic examination was performed and no evidence of vesical Schistosomiasis was observed. The urine specimens were also clear and free of any abnormalities.

It was noteworthy that of these 25 cases, three (Nos 8, 9, and 13), gave very strong presumptive evidence of relapses following previous Antimony therapy by the standard method.

Case No	Blood Examination	Urine & Stool Examination	Cercarial Skin Test Antigen Reaction
1	HG 80% Eosinophil 3% Blood Sed. Rate not performed Other Investigations - none.	Ova S. Haematobium ++ Stool examination -	+ (Positive)
2	R.B.C's 4,830,000 HG 73% Eosinophils 2% Blood Sed. Rate not performed Other investigations - Sigmoidoscopy Nov '45. Findings - No ulceration of ano-rectal junction but some degree of varix present (early haemorrhoids).	No ova in urine or stool after repeated examinations of specimens	Oct '45+- (doubtful) Late Oct '45 + (positive)
3	B.R.C's 4,680,000 HG 60% Eosinophils 5% Blood Sed. Rate increased	No ova in urine or stool after repeated examinations of specimens.	+
4	HG 79% Eosinophils 5% Blood Sed. Rate not performed Other investigations - none.	No ova in stool or urine after repeated examinations of specimens.	Oct. '45 + - (doubtful) Nov. '45 + (positive)
5	HG 76% Eosinophils 12% Blood Sed. Rate not performed.	Ova S. Haematobium ++ Stool examination -	+ (positive)
6	HG 74% Eosinophils 9% Blood Sed. Rate 0 alight increase	No ova in urine or stool after repeated examinations of specimens	++ (strongly positive)

Cercarial Skin Test  
Antigen Reaction.

Urine & Stool Examination

Blood Examination

7

R.B.C's 4,230,000  
HG 54%  
Eosinophils 6 %  
Total White Blood Count 7,600  
Diff. Blood Count - Neuts 61  
Lymphs 32 Monos 1 Eos 6.  
Blood Sed. Rate - increased.  
Other investigations -

1. Catheter specimen of urine - culture of B. Coli.
2. Intravenous Pyelogram - right ureter and pelvis of R kidney dilated and tortuous. Report - Pyo-nephrosis.
3. Cystoscopic examination was postponed until after treatment had been given.

After repeated examinations of urine and stool one ova S. haematobium was found in urine.

+ (positive)

8

HG 84%  
Eosinophils 12%  
Blood Sed. Rate not performed

Ova of S. mansoni ++  
No ova in stool examination.

+ (positive)

9

R.B.C's 4,700,000  
HG 74%  
Eosinophils 6%  
Blood Sed. Rate not performed  
Other investigations - none.

Ova of S. mansoni ++  
in stool examination.  
No ova in urine.

+ (positive)

10

HG 78%  
Eosinophils 2%  
Blood Sed. Rate not performed  
Other investigations - none.

No ova found in either urine or stool after repeated examinations.

+ (positive)



Cercarial Skin Test  
Antigen Reaction.

Urine & Stool Examination

Blood Examination

Case No.

11	<p>HG 85% Eosinophils 3% Blood Sed. Rate not performed. Other investigations - none</p>	<p>No ova found in either urine or stool after repeated examinations.</p>	<p>+ (positive)</p>
12	<p>HG 79% Eosinophils 4% Blood Sed. Rate not performed. Other investigations - none.</p>	<p>Ova S. haematobium ++ No ova in stool examination.</p>	<p>+ (positive)</p>
13	<p>R.B.C.'s 4,930,000 HG 87% Eosinophils 15% Blood Sed. Rate not performed. Other investigations - none.</p>	<p>Ova S. mansoni ++ No ova in examination of urine</p>	<p>++ (strongly positive)</p>
14	<p>HG 83% Eosinophils 6% Blood Sed. Rate not performed. Other investigations - none.</p>	<p>Ova S. mansoni + No ova on examination of urine</p>	<p>+ (positive)</p>
15	<p>HG 81% Eosinophils 4% Blood Sed. Rate not performed. Other investigations - none.</p>	<p>Ova S. haematobium ++ obtained on histological examination of appendix tissue. Urine and Stool - no ova found on repeated examinations</p>	<p>+ (positive)</p>

16	R.B.C's 4,250,000 HG 57% Eosinophils 2% Blood Sed. Rate increased. Other Investigations - none	No ova in urine or stool after repeated examinations.	+ (positive)
17	HG 63% Eosinophils 5% Blood Sed. Rate not performed. Other Investigations - none	Ova S. haematobium + No ova in examination of stools	+ (positive)
18	HG 86 % Eosinophils 7% Blood Sed. Rate not performed. Other investigations - none	Ova S. haematobium + No ova on examination of stools.	++ (strongly positive with pseudopodia effect)
19	R.B.C's 4,150,000 HG 58% Eosinophils 24% W.B.C's 6,800 Blood Sed. Rate not performed. Other Investigations - none.	Ova S. haematobium + No ova on examination of stools.	++ (strongly positive)
20	HG 78% Eosinophils 11% Blood Sed. Rate slight increase. Other Investigations - none.	Ova S. mansoni + No ova on examination of stools.	+ (positive)
21	HG 75% Eosinophils 8% Blood Sed. Rate not performed. Other Investigations - none.	Ova S. haematobium + No ova on examination of stools.	+ (positive)

Cerarial Skin Test  
Antigen Reaction.

Urine & Stool Examination

Blood Examination

+ (positive)

Ova of S. mansoni +  
No ova on examination of  
urine.

HG 81%  
Eosinophils 7%  
Blood Sed. Rate not performed.  
Other Investigations - none.

+ (positive)

Ova of S. haematobium found  
on injection of appendix tissue  
after operation Aug 1945.  
No ova in urine or stools.

R.B.C's 4,300,000  
HG 74%  
Eosinophils 2%  
Blood Sed. Rate increased.  
Other Investigations - nonw.

+ (positive)

Ova S. haematobium ++  
No ova on examination of  
urine

HG 76%  
Eosinophils 5 %  
Blood Sed. Rate not performed.  
Other investigations -

1. Intravenous pyelogram : Report - marked tortuosity of R. ureter.  
? stricture of ureter.

2. Cystoscopic examination was to be performed after course of nitimony therapy.

+ (positive)

No ova in urine or stool after  
repeated examinations.

R.B.C's 4,800,000  
HG 84%  
Eosinophils 3 %  
Blood Sed. Rate not performed.  
Other Investigations -

1. Intravenous Pyelogram - normal.
2. Cystoscopic examination - No pathological signs of vesical Schistosomiasis and uretreic catheters passed up ureters without difficulty.
3. Barium enema - normal.
4. Sigmoidoscopy - nothing abnormal discovered.

Case No

22

23

24

25

The details of treatment of the author's twenty-five cases treated by the Multiple Technique using Sodium Antimonyl Tartrate (S.A.T), were as follows:-

Note: S.A.T. has been used as an abbreviation for Sodium Antimonyl Tartrate in the context.

The dosage of Sodium Antimonyl Tartrate was standard throughout the series and the total dose of the drug for each case was dependent on the body weight. 12 mgm. S.A.T. to 12 lbs body weight was the basis used. Therefore, a patient weighing 144 lbs received a dosage of 12 grains of S.A.T. The dose was divided and administered in 5, 6, or 7 intravenous injections over a 48 hour period. No difficulty was experienced in giving the total dosage in a maximum of seven injections. In fact the distribution of dosage was altered to meet each individual case. Commencing the first injection with a dose of not more than grain I, the author found that most reactions appeared in the first three injections, notably during or immediately after the third one. In consequence the larger dosages were reserved for the later injections. All cases except one (No 6) were able to complete their courses of treatment without real difficulty.

In the/



In the one case (No 6) treatment was terminated as soon as symptoms and signs of a serious Antimonial exfoliative dermatitis appeared after the second injection. In this case a careful check on the pulse rate and heart sounds was made and no cardiac arrhythmia appeared; there was no abnormal drop in blood pressure, and no evidence of renal damage resulted; in the urine specimen examined no albumen, casts, or blood cells were exhibited on subjection to microscopical examination. The condition responded well to intravenous Sodium Thiosulphate.

The schemata of dosage was arranged to meet the requirements of each individual case. For example:-  
Case X of 130 lbs body weight would require a total dosage of grains XI Sodium Antimony Tartrate.  
Case Y of 173 lbs body weight would require a total dosage of grains XIV Sodium Antimony Tartrate.  
The administration of the drug would be given as per diagram.

	Day of admission	1st day at	2nd day at	Total Dosage
Time of injection	2 p.m. 6 p.m.	9 a.m. 2 p.m.	9 a.m. 2 p.m. 6 p.m.	
Number of injection	1	2 3 4	5 6 7	
Dosage of S.A.T. in grains	I	I II	II II	XI
Time of injection	2 p.m. 6 p.m.	9 a.m. 2 p.m.	9 a.m. 2 p.m. 6 p.m.	
Number of injection	1	2 3 4	5 6 7	
Dosage of S.A.T. in grains	I	I 1½ III	III III II	XIV½



TABLE I  
Summary of Cases Treated (Contd.)

Case No.	Type of Infection.	Eos %	Blood Sed Rate	Weight in lbs.	Total Dosage S.A.T. grains.	Afternoon of admission.		Injections and Times		Individual Dosages.	
						2 p.m.	6 p.m.	9 a.m.	2 p.m.	9 a.m.	2 p.m.
15	S.H.	4	-	141	11	I	I	I	I	II	II
16	No.	2	+	113	9½	I	I	I	I½	II	II
17	S.H.	5	-	137	11½	I	I	I½	I½	II	II
18	S.H.,.	7	-	79	7	I	I	I	I	I	-
19	S.H.,.	24	-	89	8	I	I	I	I	II	-
20	S.M.	11	+	118	10	I	I	I½	I½	II	I
21	S.M.	8	-	146	11	I	I	I½	I½	II	II
22	S.M.	7	-	119	10	I	I	I	II	II	-
23	S.H.	2	+	132	11	I	I	I	I	II	II
24	S.H.	5	-	173	14½	I	I	I	II	III	II
25	No.	3	-	136	11	I	I	I	I	II	II



The technique of administration was as follows:-

A 20 ccs. all glass Loue's type syringe with an American gauge 20 mm. or 23 mm. needle was used. The latter bore allowed for a steady slow injection of the fluid, a larger size would have made an injection lasting 5 minutes difficult as such a needle would have encouraged a rapid evacuation of the injection from the syringe. Ampoules of the drug in grains  $\bar{I}$  S.A.T. in 1 cc. or 2 ccs. ampoules B.D.H. and B.W's Co. manufacture, were used in all cases. The injection was made up to 10 ccs. volume with a 5% solution of glucose saline solution. The small amount of glucose had no obvious detoxicating or other deleterious effect on the patients. The glucose solution was taken from a 500 cc. vacoliter (Bell type) which was kept in the ward refrigerator between injections. The method of filling syringe - a long, large bore needle was attached to the syringe and 8-13 ccs. of glucose saline was drawn into the 20 ccs. syringe. The amount depended on the dosage of S.A.T. used for the particular case. In the case where grains  $\bar{I}$  of S.A.T. was the requisite dose, 8 ccs. of 5% glucose saline was added, then the gr  $\bar{I}$  S.A.T. was drawn up from the/

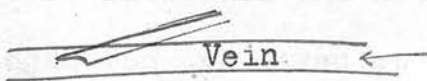
from the ampoule. In the case where grains III of S.A.T. was the requisite dose, 10-11 ccs. of 5% glucose saline was added followed by the grs III of S.A.T. from the ampoule. The needle was then changed to an American gauge 23 mm. and any air bubbles and excess saline in the syringe were expelled by pushing the piston home. This injection was given in not less than 5 minutes.

The volume of the injection varied with the requirements of each individual case, and a maximum of 15 ccs. volume injection for the stronger doses of S.A.T. (e.g. grains III) was found practicable and safe in this series of cases.

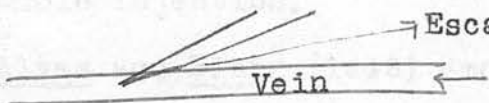
The site of injection - a superficial vein in the anterior cubital fossa was chosen and the needle inserted after pressure from a rubber tourniquet on the arm had made the vein stand out prominently; the tourniquet was applied by the Sister or Nurse in attendance at the time of the injection and it was released after the needle had entered the selected vein. The patient also assisted by opening and closing the fist of the same arm to bring the selected vein into prominence and so expedite and facilitate the further technique of the actual injection. The needle point/

needle point was thrust into the vein at an angle and the withdrawal of blood into the syringe denoted that the needle was in the vein.

Note: A long bevelled point needle piercing the vein at nearer a right than an acute angle in relation to the plane of the forearm would allow the withdrawal of blood and still have a section of the bevel in the wall of the vein and adjacent tissues, which would lead to the escape of the S.A.T. injection into the tissues with disastrous and painful result to the patient.



Correct insertion of needle in vein.



Escape of injection into tissues.

Incorrect insertion of needle in vein.

The exact time was noted, before the injection was commenced. The adult patient was instructed to keep the time by his or her watch. This ensured that the patient's attention was taken up and their interest focussed on each half minute time interval taken over the injection. Psychologically this course proved most effective. The Sister or Nurse in attendance likewise/

likewise kept a check on all cases in the series that received the injections. This measure ensured that the exact time was taken and was a further check should the patient commence a spasmodic cough or other reaction during the injection. The injection was begun with the piston moving slowly and steadily in rhythm - avoidance of any jerkiness was essential. Any unsteadiness was largely obviated by both the patient and the doctor assuming comfortable positions before the injection was introduced into the selected vein. These small points were found to make for easy and successful injections with no unnecessary stoppages to re-introduce the needle into the vein. The injection was given at the rate of 2 to 3 ccs. per minute depending on the total amount in the syringe, and a minimum time of 5 minutes was taken to complete the whole injection.

Alves and Blair (1946) emphasised "this slow and steady injection of the drug is of fundamental importance in the success of the treatment". The author of this thesis was convinced of the importance of this measure. With practice the speed of the injection could be judged accurately without in fact the aid of a watch. However, in all the cases treated a watch was used by both the patient and the Sister or Nurse.

The reactions/



The reactions to the injection therapy complained of by the patient and observed by the author were:- coughing with or without retching occurred after the 1st and 2nd injections in half the cases treated. Salivation was common after the first injection in nearly all cases.

"Rheumatic" type of pain, especially in the right more than the left shoulder was only complained of in 4 cases (nos. 1, 7, 18, and 25).

In only one case (No 6) had treatment to be discontinued owing to an acute reaction (acute exfoliative dermatitis). Vide table No II. In case No 11 the subsequent dosages had to be modified owing to an unexpected systemic upset following the second injection. Vide Table No II.

No case was observed to experience tightness or constriction of the chest and no case of abdominal cramps was met with.

Three cases (Nos 1, 3 and 19) experienced syncope and collapse, a reaction which appeared some hours after the last injection. These cases responded quickly to anti-shock measures, by the application of heat, glucose, and Spirit Ammon. Aromat. by mouth.

It was /

It was observed by the author that most cases appeared to show temporary intolerance to the drug with the second or third injection and that the larger doses administered after the third injection were well tolerated with practically no reactions at all.

Note: Table No II will show the cases that encountered reactions as well as the symptoms that were complained of.

The author's observations on the circulatory systems were:-

The pulse rate was observed in all the cases before each injection and the average rates were taken.

Reference to Table III will show that the pulse rates showed very slight slowing after succeeding injections had been given and were well within the limits of normality. Bradycardia did not occur. Further investigation of the circulatory systems by careful auscultation of the heart sounds and blood pressure readings were conducted on the series of cases. No signs of cardiac arrhythmia and no undue lowering of the blood pressure was observed.

The author's findings in common with those of Alves and Blair (1946) did not support the commonly held views that bradycardia was a frequent result of Antimony treatment, Weise quoted by Schmidt and Peter (1938). It would/

It would appear, therefore, that the phenomenon of bradycardia might appear after Tartar Emetic (Potassium Antimonyl Tartrate) administration and be due to the Potassium radicle having some direct action on the vagus nerve. In the author's series of cases the sodium salt of Antimony Tartrate alone was used.

Medical examination of all cases before discharge from hospital, the morning following the second day's treatment revealed no signs of cardiac arrhythmia or other circulatory dysfunction. Urinary specimens examined the morning after the last injection revealed no albumen or other abnormality, except in one case, No 7, where albumen and pus cells were in evidence.

The Euphoric effect observed and commented on by Alves and Blair (1946) in their series was not so evident, and in the author's cases the feeling of well being and tonic effect appeared on an average one week after completion of treatment - it was noteworthy, however, that the feeling of well being was maintained up to six weeks after completion of the treatment.

Complete rest in bed was insisted on for two hours after each injection; for the remaining time during the patient's 48 hours stay in hospital no restrictions/

restrictions were enforced, except in those cases (Nos 6 and 11) where reactions had appeared. Case No 7 was also confined to bed for the duration of treatment in view of the previous renal history.

Case No.	Age	Sex	Weight	Height	Temp.	Pulse	Respiration	B.P.	Urea	Creatinine	Cl.	Ca.	P.	Alb.	Gluc.	Uric	Notes
1	20	M	150	170	37.5	70	18	110/70	10	1.5	100	10	10	4.0	0	0	
2	22	M	160	175	37.5	75	18	110/70	10	1.5	100	10	10	4.0	0	0	
3	24	M	170	180	37.5	80	18	110/70	10	1.5	100	10	10	4.0	0	0	
4	26	M	180	185	37.5	85	18	110/70	10	1.5	100	10	10	4.0	0	0	
5	28	M	190	190	37.5	90	18	110/70	10	1.5	100	10	10	4.0	0	0	
6	30	M	200	195	37.5	95	18	110/70	10	1.5	100	10	10	4.0	0	0	
7	32	M	210	200	37.5	100	18	110/70	10	1.5	100	10	10	4.0	0	0	
8	34	M	220	205	37.5	105	18	110/70	10	1.5	100	10	10	4.0	0	0	
9	36	M	230	210	37.5	110	18	110/70	10	1.5	100	10	10	4.0	0	0	
10	38	M	240	215	37.5	115	18	110/70	10	1.5	100	10	10	4.0	0	0	
11	40	M	250	220	37.5	120	18	110/70	10	1.5	100	10	10	4.0	0	0	
12	42	M	260	225	37.5	125	18	110/70	10	1.5	100	10	10	4.0	0	0	
13	44	M	270	230	37.5	130	18	110/70	10	1.5	100	10	10	4.0	0	0	
14	46	M	280	235	37.5	135	18	110/70	10	1.5	100	10	10	4.0	0	0	
15	48	M	290	240	37.5	140	18	110/70	10	1.5	100	10	10	4.0	0	0	
16	50	M	300	245	37.5	145	18	110/70	10	1.5	100	10	10	4.0	0	0	
17	52	M	310	250	37.5	150	18	110/70	10	1.5	100	10	10	4.0	0	0	
18	54	M	320	255	37.5	155	18	110/70	10	1.5	100	10	10	4.0	0	0	
19	56	M	330	260	37.5	160	18	110/70	10	1.5	100	10	10	4.0	0	0	
20	58	M	340	265	37.5	165	18	110/70	10	1.5	100	10	10	4.0	0	0	
21	60	M	350	270	37.5	170	18	110/70	10	1.5	100	10	10	4.0	0	0	
22	62	M	360	275	37.5	175	18	110/70	10	1.5	100	10	10	4.0	0	0	
23	64	M	370	280	37.5	180	18	110/70	10	1.5	100	10	10	4.0	0	0	
24	66	M	380	285	37.5	185	18	110/70	10	1.5	100	10	10	4.0	0	0	
25	68	M	390	290	37.5	190	18	110/70	10	1.5	100	10	10	4.0	0	0	
26	70	M	400	295	37.5	195	18	110/70	10	1.5	100	10	10	4.0	0	0	
27	72	M	410	300	37.5	200	18	110/70	10	1.5	100	10	10	4.0	0	0	
28	74	M	420	305	37.5	205	18	110/70	10	1.5	100	10	10	4.0	0	0	
29	76	M	430	310	37.5	210	18	110/70	10	1.5	100	10	10	4.0	0	0	
30	78	M	440	315	37.5	215	18	110/70	10	1.5	100	10	10	4.0	0	0	
31	80	M	450	320	37.5	220	18	110/70	10	1.5	100	10	10	4.0	0	0	
32	82	M	460	325	37.5	225	18	110/70	10	1.5	100	10	10	4.0	0	0	
33	84	M	470	330	37.5	230	18	110/70	10	1.5	100	10	10	4.0	0	0	
34	86	M	480	335	37.5	235	18	110/70	10	1.5	100	10	10	4.0	0	0	
35	88	M	490	340	37.5	240	18	110/70	10	1.5	100	10	10	4.0	0	0	
36	90	M	500	345	37.5	245	18	110/70	10	1.5	100	10	10	4.0	0	0	
37	92	M	510	350	37.5	250	18	110/70	10	1.5	100	10	10	4.0	0	0	
38	94	M	520	355	37.5	255	18	110/70	10	1.5	100	10	10	4.0	0	0	
39	96	M	530	360	37.5	260	18	110/70	10	1.5	100	10	10	4.0	0	0	
40	98	M	540	365	37.5	265	18	110/70	10	1.5	100	10	10	4.0	0	0	
41	100	M	550	370	37.5	270	18	110/70	10	1.5	100	10	10	4.0	0	0	



TABLE III

Pulse Rate - Average taken before each injection.

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12men.

Injection	Rate per minute.
1st	68
2nd	66
3rd	66
4th	64
5th	64
6th	62
7th	62
7 women	
1st	72
2nd	70
3rd	70
4th	66
5th	66
6th	66
6 boys	
1st	80
2nd	80
3rd	78
4th	78
5th	78
6th	76

TABLE IV Test of Cure at Six weeks.

No of Case.	Urine & Stool Ova	Clinical Signs & Symptoms	Gain in Weight lbs.	Eosinophil %	Cercarial Test Antigen.	Skin Test Antigen.	Blood Sed. Rate.
1	No	None	+ 2	3%	-	-	-
2	No	Vague symptom	+ 1	2%	+	-	-
3	No	None	+ 3	3%	-	-	- normal
4	No	None	+ 2	3%	-	-	-
5	No	Backache	+ 2	9%	-	-	-
6	No	None	-	9%	-	-	normal
7	No	Lumbar pain	+ 2	4%	-	-	above normal
8	No	None	+ 4	7%	-	-	-
9	No	None	+ 2	4%	-	-	normal
10	No	None	+ 4½	2%	-	-	-
11	No	None	-	3%	-	-	-
12	No	None	+ 1½	3%	-	-	-
13	No	None	+ 2½	9%	-	-	-
14	No	None	+ 2	4%	-	-	-
15	No	None	+ 6	4%	-	-	-

TABLE IV. Test of Cure at six weeks (contd)

No of Case	Urine & Stool ova	Clinical Signs & Symptoms	Gain in Weight lbs	Eosinophil %	Cercarial Skin Test Antigen	blood Sed. Rate.
16	No	None	+ 2	2%	-	normal
17	No	None	+ 2½	4%	-	-
18	No	None	+ 3	3%	-	-
19	No	None	+ 3½	14%	-	-
20	No	None	+ ½	7%	-	normal
21	No	None	+ 2	6%	-	-
22	No	None	+ 3	4%	-	-
23	No	None	+ 3	2%	-	normal
24	No	backache	+ 2	4%	-	-
25	No	None	+ 1½	3%	-	-

TESTS OF CURE.

The tests of cure employed and the results obtained were as follows:-

The test of cure of cases treated was performed during the first week after completion of treatment and again six weeks later. Cure could not be assessed by one method alone, and consequently the author investigated his cases from various aspects before coming to a conclusion as to the "efficiency of the Intensive Antimony Treatment".

The tests use on his series of cases were:-

1. The absence of all clinical signs and symptoms of the disease.
2. The immediate and later examinations of urine and stool in all cases to determine the absence of viable Bilharzial ova.
3. The Cercarial Skin Test Antigen Reaction.
4. Eosinophil Counts.
5. Gain in physical well being evidenced by improved appetite and gain in weight and euphoric effect.

The author further considered that:-

6. Cystoscopy one month and three months after treatment for *S. haematobium* cases and
7. Sigmoidoscopy on at least one occasion during the six weeks/



the six weeks follow-up period in *S. mansoni* cases were essential measures to complete a thorough exhaustive test of cure in the cases treated.

Unfortunately for various reasons tests of cure 6 and 7 were unable to be performed except in a few cases. Tests 1 to 5 were similarly followed up at the six weeks stage and had the author not left S. Rhodesia in January 1946 it was his intention to carry out a further test of cure at the three months stage.

As no rapid tests of cure has as yet been devised to replace this method of approach, it is the author's considered opinion that the pronouncement of a complete recovery and cure should be withheld until the final examination of the case at the three months stage. In the examination of urine and stool in all cases of the series immediately after completion of treatment the cases with *S. haematobium* infestation (Table I) had their urines examined the day following treatment and no viable healthy ova were found. These investigations were carried out at the Pasteur Institute and Public Health Laboratory, Salisbury, for cases in the Salisbury Government Hospital, and at the Laboratory, St. Anne's Hospital, for cases treated in the latter institution. The presence/

presence of red blood cells and dead ova, i.e. ova from which miracidia did not hatch out, or those that did so but showed no characteristic mobility or activity were noted by the Laboratories. Whether the ova found appeared crenated or degenerated on microscopic examination was also observed. In the cases with active *S. mansoni* ova demonstrable before treatment, examination of the stools, i.e. the fluid portion of the first stool passed twenty-four hours after completion of treatment, revealed no living healthy eggs. The author appreciated the difficulties that stool examination entailed (a tedious and unsatisfactory business with the possibility of missing the actual ova present), but in view of the small number of these cases examined the author was confident that the specimens submitted to the Laboratories were given thorough and exhaustive examinations. The few cases where ~~no~~ demonstrable ova of *S. haematobium* or *S. mansoni* were found prior to treatment also had their urine and stools submitted for examination. In these cases no definite evidence of the passage of living ova was reported. Throughout the series of twenty-five cases treated the Laboratory reports showed the presence of dead ova in five cases - Nos 5, 7, 12, 19 and 23.

On the/

On the basis that the absence of ova from urine and stool two months after treatment was used as a criteria of cure in Alves and Blair's (1946) series of cases, the author applied a similar test of cure at six weeks after completion of treatment in his own cases. The examination of urine and stool, six weeks after treatment had been completed, revealed the absence of ova from urine and stool in all cases. The other tests were used in conjunction.

The Cercarial Skin Test Antigen Reaction performed on the cases six weeks after completion of treatment showed that all except one case, No 2, under review gave "Skin Test negative", results; vide Table IV.

The inversion from a positive to a negative reading was in accordance with the indisputable evidence that death and dissolution of the Schistosomes, male and female, had occurred, vide Alves and Blair (1946).

The author himself was convinced that the Skin Test negative Reaction does indeed indicate the destruction of the parasites. All the author's cases had been skin tested at his surgery some days before their admission to hospital. It was not, therefore, possible to follow the observations of the Skin Test phenomenon that appeared when the Skin Test Reaction was performed immediately before treatment was commenced/.

commenced. The stimulation of the adjacent skin area by liberated "toxins" freed by the Schistosoma after the initial injection of S.A.T. had been given and described by Alves and Blair (1946). The absence of clinical signs and symptoms of disease occurred in all cases within the first two weeks following completion of treatment and the patients experienced a feeling of exhilaration and well being which had not been their happy lot for many months previously. One symptoms, backache, tended to persist in cases Nos. 5, 17, and 24. The disability, however, was much less/severe after treatment had been given. The distribution of the backache was similar in all three cases - in the lumbo-sacral region and extending particularly to the right lumbar muscles. This symptoms in the author's opinion had a definite relationship to the pathological state resulting from vesical Schistosomiasis at the site of predilection, the right ureter and bladder ureteric orifices. The symptoms of backache in a case of fairly recent infestation governed by a history of urinary symptoms, was almost without exception completely relieved, after the treatment. It was the chronic case of many years standing, as in case No 24, where the symptoms persisted indefinitely - in this type of case

cystoscopy/



cystoscopy and ureteric dilatation was an essential measure to promote complete recovery. Unfortunately case No 24 refused to subject himself to this form of treatment. The euphoric effect in the author's series of cases appeared gradually and the average case did not experience this exhilarating effect for up to a week after completion of treatment. This observation did not compare with the findings of Alves and Blair (1946).

Gain in weight and feeling of well being. The general improved feeling of physical fitness, coupled with improved appetite in all cases was anticipated to be followed by an increase in weight. Appetite may be satiated in S. Rhodesia where government rationing was restricted to butter and sugar only. From this aspect the results were disappointing particularly as the cases had been selected and no case was suffering from mixed helminthic infections, marked degree of hypochromic anaemia, or other chronic diseases. The only substantial increase in weight was seen at the six weeks follow-up period, in certain of the cases treated, Nos. 8, 10, 13, 18, and 22, and all adolescents. An average gain of 3-4 pounds had occurred. Allowance had also to be made in/

made in these cases for the ordinary rates of physiological development at this adolescent period. One exception to this finding was case No 15, who felt in splendid health and had gained 6 lbs in the six weeks interval. Weight, therefore, seems to have no real bearing in assessing a cure in cases of Schistosomiasis.

The Eosinophil counts taken at the six weeks follow-up period and comparing them with those taken before treatment gave interesting readings. It was seen from Table I that the Eosinophil counts before treatment varied considerably. Case No 19 gave a relatively high Eosinophilia - 24%. Cases Nos 5, 8, 13, 18, 20, 21 and 22 showed a moderate rise. The remaining cases fell within normal limits. It was highly improbable that case No 19 had had a recent infestation, though this possibility was naturally considered. The author suspected that the earlier Ankylostomiasis infestation which had only been successfully eradicated in September 1945, may have had some bearing on this high % count. On reviewing the counts, six weeks after treatment, it was observed that those cases with normal Eosinophil Counts hardly varied while those with Eosinophilia before/

before treatment all showed a substantial reduction. A full blood count, red and white and differential B. counts, were conducted in all cases but no significant features were present in these, and for that reason they have been omitted.

The Blood Sedimentation Rates were performed only on the female cases, Nos 3, 6, 7, 9, 16, 20 and 23, and showed an interesting fact in line with previous work on this subject. All cases showed an increased rate before treatment and a slower rate six weeks after treatment. No estimation on the urinary excretion of Antimony was made in the author's series of cases, for reasons of economy.

Research work on this aspect was performed by Schmidt and Peter (1938) who established that the greater part of Antimony was eliminated from the body by the kidneys. Alves and Blair (1946) conducted investigations on eight of their cases (urines being submitted to the Government Analyst, Salisbury), and from their results they maintained that in the Intensive Antimony Treatment by multiple syringe technique it appeared that 70-80% of the Antimony injected in the body was retained in the body at the end of 72 hours. This figure corresponded to gr VIII S.A.T. (520 mgm). It was this high concentration/

concentration of Antimony in the body over this short period which was responsible for the rapid disappearance of healthy ova, the distribution of the male and female Schistosome and the apparent cure in all cases.

The relapse rate:

In the author's series of 25 cases there appeared to be no definite relapse case apart from one doubtful case, No 2, at six weeks after completion of treatment. This patient was still subject to vague symptoms, of poor appetite, irregular bowel action, and the Cercarial Skin Test Antigen gave a doubtful reaction. The author was of the opinion that the symptoms were attributable to a neurotic introspectiveness rather than that active Schistosomiasis was still active.



SUMMARY:

25 cases (11 with active vesical Schistosomiasis, 6 with active intestinal Schistosomiasis, one case of old *S. mansoni* infestation, and 7 cases that revealed no evidence of Schistosomiasis ova in urine or stool, but who, clinically and from the further tests conducted, gave a Presumptive Diagnosis of the disease), were treated with Sodium Antimony Tartrate using a "Multiple Syringe Technique" in 48 hours. No viable ova were found in the urine or stool immediately after the treatment nor at the six weeks' follow-up period. In all the cases but one (No 2) the Cercarial Skin Tests Antigen was negative six weeks after the treatment course, and the one case gave a doubtful positive reading. In case No 6, treatment had to be terminated after the second injection of Ant. Sod. Tart. owing to the sudden appearance of an acute Antimonial Dermatitis. This case was, therefore, of no further significance in summarising the series of cases, but an interesting feature was that the case in point, who had suffered from absolute sterility for six years, fell pregnant the month after her initial introduction to the Antimony treatment.

Discussion and Conclusions:

It has been shown that the incidence of Bilharzia infestations among European residents in S. Rhodesia is alarmingly high, a figure approaching that affecting the native races. Further that though the European population is relatively small in comparison to the native, the intensive treatment of Antimony for the native case advocated by Alves and Blair (1946) has a similar bearing on the mass treatment of the European population living in districts where the disease reaches hyperendemic proportions. Mass treatment of any large community is complicated not only by the number of skilled personnel required and the amount of energy, time and money, that must be expended, but by the reluctance of the average person to continue any long course of intensive treatment. This new technique of treatment for a chronic insidious disease with its attendant heavy morbidity does indeed appeal to the European sufferer in S. Rhodesia by its rapidity and by offering a quicker means of cure. In the author's opinion the method of conducting such a therapeutic measure for a large number of patients, as for instance among children and among Railway employees, may be applied in S. Rhodesia in a practicable way.

In view/

In view of an extensive and up-to-date Government Hospital System existing in the country it should be a fairly easy matter to set aside two small wards of 5 bed capacity each for male and female cases in the bigger institutions. A trained sister to be in attendance to prepare the necessary injection materials, and for the doctors to carry out the treatments at weekends, particularly, would be a means of dealing with a large number of patients in the quickest, most efficient, effective, and economical way. By applying such facilities to effect a cure and to increase the well being and potential power of the European sufferer of Schistosomiasis in S. Rhodesia, warrants the earnest attention of the Government Medical Authorities of the Colony.

A. (2).

The Control Series of twenty-five cases of Schistosomiasis (both vesical and intestinal) treated by Sodium Antimony Tartrate, using the old established technique of intravenous injections on alternate days over a period of 3-4 weeks was conducted by the author between September and December 1945. The cases of this series were taken from the author's private practice and from among employees of the Rhodesia Railways.

All the cases were European of both sexes, and adult male and female and children were among the total of cases treated. Treatment was conducted throughout from the author's private surgery and from the Railway surgery and the patients were essentially out patients.

In this series of 25 cases -

12 men  
7 women and  
6 children were included.

Reference to the details of the case histories, the diagnosis and treatment, with the amounts of Sodium Antimony drug given, and the length of time of the course for each individual case treated follow:-



CONTROL SERIES OF 76 CASES TREATED BY  
SODIUM ANTIMONY TARTRATE - OLD TECHNIQUE.

Test of cure 6 weeks.

Case No.	Name	Age Sex	Clinical History	Type of infection	Eos %	Cercarial Skin Test	Treatment	Ova in Urine & Stool	Eos %	Cercarial Skin Test
1.	C. (D).	10 yrs F	Urinary symptoms & slight loss of wt. Listless. School work poor. Duration - 6 mths.	S.H.	7	+	S.A.T. I-V injs. in 4 wks. Total dosage - grs. 15	No	6	-
2	A. (P).	30 yrs M	Urinary symptoms - haematuria & back-ache. Loss of wt. & debility. Duration - 6 months	S.H.	5	+	S.A.T. injs. I-V in 5 wks. grs. 28	No	5	+
3.	F (C.I)	38 yrs M	Old infection - has had 4 courses of S.A.T. in 1945. Still has backache & no energy. Duration - 2 years.	? S.H.	4	+	S.A.T. injs. I-V in 4 wks. grs. 30.	No	4	+
4	T (M)	34 yrs F	Abdo pain, malaria, anaemia, constipation, menstrual disorders. Duration - 6 years.	No	4	+	S.A.T. injs. I-V in 5 wks. grs 24	No	4	-
5	P (P)	20 yrs F	Gastric discomfort loss of wt. constipation, def. risk of infection. Duration - 6 months.	S.M..	4	+	S.A.T. injs. I-V in 4 wks grs 24	No	4	-

Case No	Name	Age Sex	Clinical History	Type of Infection	Eos %	Cercarial Skin Test	Treatment	Ova in Urine & Stool	Eos %	Cercarial Skin Test
6	H. (M)	19 yrs F	S. mansoni 1940 Bulawayo. No def. symp but exam find- ings below in detail. Duration - 5 yrs.	No	74	+	S.A.T. I-V injs. in 4 weeks. grs. 24.	No	58%	+
7	K (E.J)	26 yrs M	Gastric symp. loss of wt. Malaria. Duration - 6 months. Occupation - Fireman Railway.	S.M.	5	+	S.A.T. I-V injs. in 4 wks grs. 30	No	5%	-
8	S (J)	21 yrs M	Urinary symp c terminal haematuria. Malaria. Duration - 6 mths.	S.H.	5	+	S.A.T. I-V injs. in 4 weeks grs. 30	No	5%	-
9	M (I)	16 yrs M	Backache loss of wt. no appetite, onset on active service in M.E. in R.A.F. Duration - 1 yrs.	No	8	+	S.A.T. I-V injs in 4 wks grs 30	No	6%	+
10	H (N)	16 yrs F	Gastric symp & acute appendicitis & then diagnosed. Duration years.	S.H.	3	+	S.A.T. I-V injs. in 4 wks. gra. 22	? dead ova	3%	-
11	A. (G)	12 yrs M	Strabismus worse Bad school reports No energy, listless. Duration 9 mths.	S.M.	6	+	S.A.T. I-V injs in 4 wks grs 18	Ova	6%	+

Case No	Name	Age Sex	Clinical History	Type of Infection	Eos %	Cercarial Skin Test	Treatment	Ova in Urine & Stools	Eos %	Cercarial Skin Test
12	W. (B)	14 yrs M.	Old S.H. infest. in par treatment 1944 & defaulted. Recurrence of symptoms. Duration - 6 mths.	S. H.	6	+	S.A.T. I-V injs in 4 weeks grs. 18	No ova	5	-
13	M (B.C)	19 yrs M	Urinary symp & haematuria, malaria, loss of wt & debility. ? repalse.	S.H.	13	+	S.A.T. I-V injs. in 4 weeks. grs. 30	Ova	9	+
14	O (J)	36 yrs M	Asthma subject for years. Loss of wt. & debility. Occup - Rly guard.	S.H.	17	+	S.A.T. I-V injs in 5 weeks grs. 30.	No	12	+
15	A (L)	36 yrs M	Loss of wt. listless no energy, vague renal symptoms. Duration - 12 mths.	S.H.	32	+	S.A.T. I-V injs. in 4 weeks grs 30	No	3	-
16	Mrs H (B)	24 yrs F	Psoriasis for years. Gastric symptoms like cholecystitis. Loss of wt. debility. Duration - 2 years.	-	5	+	S.A.T. I-V injs in 4 weeks grs 14	No	4	+
17	Mrs S (W.G.)	31 yrs F	Loss of wt. debility anorexia, always tired malaria history. Duration 18 mths.	No ova	4	+	S.A.T. I-V injs in 4 weeks grs. 24	No ova	4	-

Case No	Name	Age Sex	Clinical History	Type of Infection	Eos %	Cercarial Skin Test	Treatment	Ova in Urine & Stools	Eos %	Cercarial Skin Test
18	Mc (C)	17 yrs M.	Vague urinary symp. loss of wt. no energy debility & listless. Duration 2 yrs.	No ova	5	+	S.A.T. I-V injs in 4 weeks grs 28	No	5	+
19	I (A)	14 yrs M	Gastric symp. loss of wt. debility. malaria history. Duration 9 mths.	No ova	5	+	S.A.T. I-V injs grs 18	No	5	-
20	L (W)	12 yrs M	Stammer ++ & facial tic slight urinary symp. not haematuria. Duration 6-11 mths.	S.H.	9	+	S.A.T. I-V injs. gra. 17	No	7	+
21	D (F)	13 yrs M	Stammer, loss of wt. & urinary symp. Previous S. mansoni infection - 3 yrs ago	.H.	5	+	S.A.T. I-V injs grs 18	Ova	5	+
22	Mrs. G (P)	23 yrs F	Gastric symptoms, loss of wt. debility & anorexia. Previous history S. mansoni 3 yrs.	S.M.	5	+	S.A.T. I-V injs. grs. 24	No	5	-
23	S (R.C.)	27 yrs M	Vague gastric symp. no energy, anorexia. Prev. history S. mansoni 4 yrs ago.	No	6	+	S.A.T. injs. I-V gra 30	No	5	-



Case No	Name	Age	Sex	Clinical History	Type of Infection	Eos %	Cercarial Skin Test	Treatment	Ova in Urine & Stool	Eos %	Cercarial Skin Test
24	Mc (J)	26 yrs	M	Backache, loss of wt. debility & vague urinary symptoms. Duration - 4 yrs.	S.H.	4	+	S.A.T. I-V injs gra 30	No	3	+
25	B. (S)	46 yrs	M	Gastric or hepatic symptoms for years. anorexia & constipation. Malaria history.	No	4	+	S.A.T. I-V injs gra. 30.	No	4	-

11 cases were suffering from active vesical Schistosomiasis.

1. case was suffering from doubtful vesical Schistosomiasis.

4. cases were suffering from active intestinal Schistosomiasis.

9 cases had no demonstrable ova in urine or stool.

23 cases in the series gave a positive result to the Cercarial Skin Test Antigen.

2 cases (Nos 3 and 4) gave doubtful positives.

The Eosinophil Counts in the series revealed an Eosinophilia to a marked degree (i.e. over 8%) in six cases.

Case No 6 was interesting. A history of previous *S. mansoni* infestation was given, for which an uncompleted course of Fouadin had been given in Bulawayo 4 years previously. In view of this history and a positive Cercarial Test this case was given a further course of Antimony, S.A.T. intravenous injections being given. Subsequently (see under Review of Eosinophil Counts), this case was more fully investigated and a diagnosis of tropical eosinophilia was made.

In case No 20, the child had active *S. haematobium* ova in the urine and it was significant on clinical examination of this case that a progressive hesitancy of speech/

speech and a facial tic had occurred prior to treatment. These physical abnormalities entirely disappeared 6 weeks after treatment.

Case No 13 had a fairly recent infestation of *S. haematobium* and classical urinary symptoms were present.

In case No 14 a bronchial asthma subject of uncertain allergic origin may have influenced the Eosinophilia.

The Test of Cure six weeks after individual cases were treated were based on the absence of active Schistosome ova in the urine and/or stool together with the application of the other methods used in the earlier series of 25 cases by the intensive method. All cases except three (Nos 11, 13 and 21), were found to have no ova or non-viable ova. The Laboratory Reports on these suggested that the female Schistosome was still viable and was passing active ova. Eosinophil Counts showed that all percentages had decreased to some extent though cases Nos. 6, 13, and 20 remained abnormally high. Cercarial Skin Test Antigen revealed the fact that 13 cases gave a negative reaction. 3 cases gave positive reactions and 9 cases gave doubtful positive reactions.

SUMMARY:

25 cases of active or suspected Schistosomiasis infestation (both vesical and intestinal cases), were given treatment by intravenous Sodium Antimony Tartrate by the standard technique. As these cases were all out-patients and were treated by the author at the Railway and at his own surgery, it was impossible to get a comprehensive test of cure immediately after completion of treatment in each individual case. In consequence this was delayed until the six weeks period and revealed the fact that 22 cases had no viable ova in stool or urine and 3 cases had viable ova in stool or urine at this stage. The Cercarial Skin Test Antigen performed six weeks after completion of treatment revealed a positive reaction on the three cases, Nos 11, 13, and 21. Viable ova were found in these cases. "Doubtful positive" reactions appeared in 9 cases, and negative reactions in the other 13 cases.



COMPARATIVE TABLES.

Series A (1)

17 Cases of Active Schistosomiasis treated by New Technique. Test of Cure at 6 weeks.

Series A (2)

16 Cases of Active Schistosomiasis treated by Old Technique. Test of Cure at 6 weeks.

Case No	Eos %	Ova Present	Circ- -orial Skin Test	Case No	Eos %	Ova present	Circ- -orial Skin Test.
1.	3	-	-	1	6	-	-
5	9	-	-->Eos	2	5	-	+ -
7	4	-	-	3	4	-	-
8	7	-	-->Eos	5	4	-	-
9	4	-	-	7	5	-	-
12	3	-	-	8	5	-	-
13	9	-	-->Eos	10	3	-	-
14	4	-	-	11	6	ova	+ x
15	4	-	-	12	5	-	-
17	4	-	-	13	-	ova	+ x
18	3	-	-	14	12	-	+>Eos x
19	14	-	+>Eos	15	3	-	-
20	7	-	-->Eos	20	7	-	+ -->Eos x
21	6	-	-	21	5	ova	+ x
22	4	-	-	22	5	-	-
23	2	-	-	24	3	-	-
24	4	-	-				

Percentage of Cures in -

Series A (1). 17 cases (No 6 and the cases with absence of ova before treatment were omitted), treated by a 2 day Intensive Antimony Therapy Method and

Series A (2). 16 cases (cases with no ova before treatment were omitted), treated by the Standard 3-4 weeks Treatment of Sodium Antimonyl Tartrate.

Accepting Test of Cure at six weeks after completion of the treatments and applying the same methods of Test of Cure to both series, viz:-

A Test of Cure was considered certain when -

(a) No viable ova were found in urine or stool examinations.

(b) There was a stationary or diminished Eosinophil Count not necessarily within the maximum limit of normality (4-5% if the other tests were negative).

(c) The Cercarial Skin Test Antigen gave a negative report.

On this basis:-

The Percentage Cures in Series A (1) was 94%

" " " " " A (2) was 69%

B.

Cases of Chronic Bilharzial Appendicitis.

The author has taken 25 cases operated upon during 1945 and given details of 7 cases of the series. Schistosomiasis infestation was revealed at operation in cases Nos. 2, 3 and 4, of this series. Case No 25A, not operated upon but which simulated an acute attack of appendicitis, has been described.

Case No	Name	Sex	Clinical History	History of Schistosomiasis Urine & Stool Examinations	Investigations	Examination Clinical Diagnosis before operation.
1	Mrs. S. 21 yrs	F	Vague symptoms of colicky type for 12 yrs. Sudden acute attack appendicitis.	No, but risk. Urine) no ova. Stool)	W.B.C.'s 20,000 Poly-leucocytes.	Acute obstructive appendicitis.
2.	H. (N) 16 yrs.	F	Attacks of grumbling type of appendicitis for 12 mths. Sudden acute exacerbation.	No, but risk Urine) Stool) No ova	W.B.C.'s 14,400 Poly-leucocytes.	Acute obstructive appendicitis.
3.	S. (B) 19 yrs	M	Sudden acute attack of appendicitis. No previous history.	No, but risk. Urine) Stool) no ova	W.B.C.'s 16,800 Poly-leucocytes.	Acute obstructive appendicitis.
4	V (D) 11 yrs.	M.	Attack of acute abdo. colic for 4 days. Swelling localised & case transferred to Salisbury from Mandell's District - a distance of 40 miles.	No, but risk Urine) Stool) no ova.	W.B.C.'s 21,400 Poly-leucocytes	Appendix abscess.
5.	K. (S.L) 18 yrs	M.	Attacks of appendicular colic for 6 months.	No. Risk of infestation. Urine) Stool) no ova	W.B.C.'s 8,200 Normal Diff. Count.	Subacute (grumbling) appendicitis.
6	Mrs. Mc. 24 yrs.	F	Intermittent attacks of abdo pain localised to R.I.F. Duration 12-18 months.	No ? risk. Urine ) Stool ) no ova	W.B.C.'s normal iff. count.	Subacute appendicitis.



Case No	Name	Age	Sex	Clinical History	History of Schistosomiasis Urine & Stool examination	Investigations	Examination Clinical Diagnosis before operation.
7	H (M)	16 yrs	F	Attacks of appendicular colic for 9 mths. and sudden acute exacerbation	No, but risk. Urine } Stool } no ova	W.B.C's 9,400 Poly-leucocytes.	Acute a pendicitis.
8.	W. (F)	11 yrs.	F	Recurrent attacks of pain R.I.F. c nausea and vomiting. Duration 12 months.	No but risk. Urine ) Stool ) no ova	W.B.C's 7,300 Diff. Count normal.	Subacute appendicitis.
9	H (S)	17 yrs	M	Recurrent attacks of acute pain R.I.F. Duration 10 months.	No, but risk Urine) Stool) no ova	W.B.C's 6,800 Diff. count normal.	Subacute appendicitis.
10	G (M)	21 yrs	F	Vague abdo pain for 12 months, then sudden acute exacerbation c nausea and vomiting.	No, but risk. Urine) Stool) no ova	W.B.C's 8,740 Poly-Leucocytes.	Acute Appendicitisi.
11	Mrs. B (J)	18 yrs.	F	Recurrent attacks of appendicular type of colic. 12 months.	No, but risk Urine) Stool) no ova	W.B.C's 7,600 Diff. count norm=l.	Subacute (grumbling) appendicitis.
12	S (R.C.)	23 yrs	M	Gastric symptom of abdo type following influenza. uration 5 months.	No but risk Urine ) Stool ) no ova.	W.B.C's 7,400 Slight poly- Leucocytes.	Subacute catarrhal appendicitis.
13	P (E)	18 yrs	F	Frequent attacks of acute appendicular type of colic. Duration 12 months.	Yes, 1942. Urine) Stool) no ova	W.B.C's 7,220 Slight leucocytes.	Subacute appendicitis.

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Case No	Name	Sex	Clinical History.	History of Schistosomiasis Urine & Stool Examination	Investigations.	Examination. Clinical diagnosis before operation.
14	D (F) 14 yrs	M	Acute abdo discomfort following influenza. Duration 2 weeks.	No. Urine) No ova Stool)	W.B.C.'s 7,800 Diff. Count Polymorphocytes.	Subacute catarrhal appendicitis.
15	C (A) 22 yrs	M	Attacks of appendicular colic and duodenal ulcer symptoms 12 months. No response to medical treatment.	No, but risk (farmer) Urine) No ova. Stool)	Ba series ? N.A.D. W.B.C. normal.	Subacute Appendicitis.
16	T (M) 18 yrs	M	Recurrent attacks of pain in R.I.F. & nausea. Duration 10 months.	No, ? risk Urine) no ova. Stool)	W.B.C. normal	
17	B. (A) 15 yrs.	F	Recurrent attacks of pain in R.I.F. constipation, anorexia and vomiting with attacks. Duration 12 months.	No, but risk. Urine) no ova. Stool)	W.B.C. normal.	Subacute (grumbling) appendicitis.
18	W (B) 12 yrs	F	Sudden acute attack of abdo pain with syncope followed by localising signs to Mc Burney's point. 2 previous mild attacks.	No and no risk. Urine) no ova Stool)	W.B.C. normal	Acute obstructive appendicitis.
19	S (B.F) 26 yrs	M	Intermittent attacks of pain in R.I.F. nausea and vomiting duration 12 months.	No, but risk. Urine) no ova. Stool)	W.B.C normal	Subacute appendicitis.

Case No	Name	Sex	Clinical History	History of Schistosomiasis Urine & Stool Examinations.	Investigations.	Examination. Clinical diagnosis before operation.
20	T (R) 11 yrs	M	Repeated attacks of bilious colic and pain in R.I.F. Duration 12018 months.	No ? risk. Urine) Stool) no ova	W.B.C. normal	Subacute appendicitis.
21	P (P) 21 yrs	F	Attacks of pain R.I.F.† off and on for 12 mths.	Yes, old S.M. infest. Urine) Stool) no ova.	W.B.C. normal	Subacute appendicitis.
22	De V (C) 17 yrs.	M.	Repeated attacks of appendicular colic, also slight urinary symptoms of burning micturition. Duration - 9 months.	No ? risk Urine) Stool) no ova	W.B.C. normal	Subacute appendicitis.
23	C (M) 24 yrs	F	Attacks of acute abdo colic with bilious vomiting also severe dysmenorrhoea. Duration - 14 mths.	No. Urine) Stool) no ova	W.B.C. normal.	Subacute appendicitis or ? ovarian.
24	K (M) 24 yrs	M	Ill since 1940 with vague symp of duodenal ulcer. backache, no def. renal symp. Old S.M. infest. treated with Sod. Ant. Tart.	No, but occupational risk. Urine) Stool) noova.	Ba series N.A.D. I-V pyelogram normal	Chronic appendicitia ? renal stricture.
25	L (A.J.C) 49 yrs	M	Gastric symp for 7 yrs. diagnosed nervous dyspepsia with sudden acute exacerbation of acute attack of appendicitis.	No, but occupational risk. Urine) Stool) no ova.	Ba series N.A.D. I-V pyelogram N.A.D.	Acute obstructive appendicitis.

Case No 25A:

Mc.(J.): aged 26 years: male: occupation -  
Railway fireman, 8 years.

History: Since 1941 the patient has had four attacks of sudden acute abdominal pain accompanied by nausea and vomiting. Between attacks health good, appetite good, and bowels regular.

Previous History: Vesical Schistosomiasis (S. naematobium) 1931 and course of S.A.T. I-V given. Otherwise health very satisfactory.

Examination: No localising signs of tenderness or rigidity found over McBurney's point on each attack.

Diagnosis: Acute renal colic differential diagnosis from acute appendicitis and acute biliary colic.

Treatment: On each attack patient was admitted to hospital and put under observation. Morphia gr.  $\frac{1}{4}$  and Atropine gr. 1/100th given hypodermically on admission.

Result: Immediate relief of symptoms.

Subsequent Treatment: Cystoscopy and ureteric dilatation was carried out on each occasion. The right ureter was found to have chronic Schistosomiasis with ureteric stricture formation.

Note: The author attended the patient during the last two attacks - in Feb. 1944 and Sept. 1945.



Case No. Operation & Macroscopic Findings Report. Laboratory (Public Health Laboratory) Pathological Diagnosis Result & further treatment.

1 23.7.45 (emergency)  
Appendix long and acutely inflamed tip; body at mid section kinked due to old adhesions, no subserous pseudo-bilharzial tubercles seen. Rt. ovary & tube - normal.

2.8.45.  
Morbid Anatomy: a small amount of fibrous purulent exudate is seen on the surface. On cross section the tube shows no gross evidence of inflammatory changes in the wall. No schis. ova found on digestion.  
Histology: Sections show the picture of an acute suppurative appendicitis.

Acute supp- non- + Bilharzial  
Cure.

2 23.10.45 (emergency)  
Appendix retro-caecal & bound down by old adhesions. Pseudo miliary Bilharzial tubercles present in large numbers on mesentery of caecum and appendix.

25.10.45.  
Morbid Anatomy: 3 minute greyish white tubercles are present on the surface of the appendix. When crushed & examined however reveal no ova. Numerous ova of S. haematobium present in the deposit of the digested tissue.  
Histology: Sections reveal chronic inflammatory cells with few ova of S.H. No tubercles are seen on section.

Chronic Course  
Bilharzial of Gr. 30  
Appendicitis Sod. A nt  
Tart. I- V &  
cure.

3. 29.10.45 (emergency)  
Acutely inflamed appendix with thick mucopurulent pus in lumen. Kink of body causing obstruction from chronic and recent adhesions. Numerous miliary pseudo-tubercles on caecum and ileum.

7.11.45.  
Morbid Anatomy: Numerous grey white tubercles are present on the surface of appendix. When crushed & examined ova of S. haematobium found. Numerous S.H. ova present in the deposit of the digested tissue.  
Histology: Sections reveal chronic inflammatory changes and cells with ova & tubercles seen on section.

Acute obstructive  
appendicitis  
super-imposed  
on chronic  
Bilharzial  
treatment.  
Intensive  
Antimony  
&  
Therapy.  
Cure.

4 24.11.45 (emergency)  
 Large appendix abscess with free B. Coli fluid and pus. Appendix gangrenous and attached to visceral surface of abdominal wall. Difficult to define base owing to numerous adhesions. Retro-grade appendicectomy performed. Drainage & sulphapyridine. No evidence of miliary pseudo tubercles.

5. 15.4.45 (interval)  
 Appendix large, mobile mesatery. No macroscopic evidence of Schistosomiasis tubercles.

13 28.8.45(Interval)  
 Subacutely inflamed appendix with recent adhesion formation. No evidence of pseudoOiliary tubercles. R ovary with small follicular blood cyst. R tube healthy.

1.12.45.  
Morbid Anatomy: From material submitted for examination acute inflammatory changes seen. A few Bilharzial ova found from the digested tissue showed marked degenerative changes probably due to autolytic action. These eggs appeared to be S. haematobium.

15.4.45:  
Morbid Anatomy: No gross pathology seen and no ova of Bilharzia recovered from digested tissue.

10.9.45:  
Morbid Anatomy: Inflammatory changes present in walls but no ova on S. haematobium found on digestion. Histology: Section reveals chronic inflammatory changes but no ova found.

Gangrenous Bilharzial appendicitis with abscess formation.

Subacute appendicitis.

Chronic non-Bilharzial appendicitis.

Relieved.

Cured.

12 6.10.45. (interval)

Appendix large with freely movable mesentery. Congestion of vessels but no pseudoOmliliary tubercles seen macroscopically.

14.9.45:

Marbid Anatomy: Appendix average normal length but tender to touch.

On cross section a certain increase of fibrosis is evident but there are no evidences of an acute inflammation.

Histology: Fibrinous exudate seen in the lumen of the appendix with acute inflammatory cells. Vessels in serosa are congested and fibrosis in subserosa.

Catarrhal  
appendicitis

Relieved.

The remaining cases in the series gave no evidence of Schistosomiasis on submission of the appendices to Laboratory for histological examination. The diagnoses were as follows:-

Case No.	Pathological Diagnosis.
6	Subacute appendicitis (non-Bilharzial)
7	Acute catarrhal appendicitis (non-Bilharzial)
8	Subacute appendicitis (non-Bilharzial)
9	Subacute appendicitis (non-Bilharzial)
10	Acute inflammatory appendicitis (non-Bilharzial)
11	Subacute appendicitis (non-Bilharzial)
14	Acute catarrhal appendicitis (non-Bilharzial)
15	Subacute appendicitis (non-Bilharzial)
16	Chronic appendicitis (non-Bilharzial)
17	Chronic appendicitis (non-Bilharzial)
18	Acute appendicitis (non-Bilharzial)
19	Chronic inflammatory appendicitis (non-Bilharzial)
20	Subacute appendicitis (non-Bilharzial)
21	Subacute appendicitis (non-Bilharzial)
22	Subacute appendicitis (non-Bilharzial)
23	Subacute appendicitis (non-Bilharzial)
24	Chronic inflammatory appendicitis (non-Bilharzial)
25	Acute gangrenous appendicitis (non-Bilharzial)



SUMMARY:

Twenty-five cases of the author's suffering from various types of appendicitis and operated on during 1945 are described.

Seven cases of the series are described in detail and of these,

Two cases (Nos 2 and 3) revealed the macroscopic signs of chronic Bilharzial appendicitis confirmed by the Laboratory findings. One case (No 4) showed no macroscopic signs of the disease, but ova were found on Laboratory examination of the appendix tissue submitted. One of these cases (No 3) was treated by the Intensive Antimony Treatment after convalescence. The other two cases (Nos 2 and 4) received a course of Sodium Antimonyl Tartrate by the old method. The remaining cases all proved non-Bilharzial in type showing different stages of inflammation according to the Public Health's Laboratory reports received. The clinical diagnosis made before operation and the subsequent post-operative diagnosis on the histopathological findings are given for comparison. In the three cases of chronic Bilharzial appendicitis, the *S. haematobium* was found to be the infecting agent, that is the vesical one. One case, No 2bA, is described to illustrate the difficulties that are met with and the importance of the/

of the differential diagnosis in these cases. The importance of having a routine histological examination of all appendices removed is obvious, in view of the fact that Schistosomiasis may lie quiescent for years. Only by such an examination of the appendix may the real diagnosis of Schistosomiasis be established in these cases, and the correct follow-up treatment after convalescence be instituted.

CONCLUSIONS:

This series of cases on appendicitis have been added to the treatise in order to stress the importance of a chronic disease, Schistosomiasis, in its relation to the appendix, per se, and secondly to emphasise the fact that the infecting agent is always the *S. haematobium* and not the *S. mansoni*. Rosin (1942) in his article on chronic Bilharzial appendicitis gave an account of the disease illustrated by 64 selected cases of definitely established Bilharziasis over a period of five years. The author took a series of 25 cases of appendicitis that he diagnosed and treated surgically in 1945, they were in no way selected cases. Nevertheless three cases from the series revealed the unsuspected disease of Bilharzial appendicitis with, in each case, an acute exacerbation of symptoms shortly before operation.

The/

The importance of the condition, and its fairly prevalent occurrence in S. Rhodesia and S. Africa, is stressed.

One Hundred and Ten Cases with Eosinophil Blood Counts and Cercarial Skin Test Antigen Reactions - taken from different sections of the author's practice - private cases, adults and children and Railway employees.

CHILDREN                      SERIES A.

Case No	Name Age Sex	Ova in Urine or Stool	Eos %	Cercarial Skin Test
1	A (J) 11 yrs F	No	2	-
2	B (W) 9 yrs F	No	5	-
3	D (U) 9 yrs F	No	3	-
4	C (D) 10 yrs F	S.H.	7	+
5	R (H) 13 yrs M	S.H + S.M.	5	+
6	R (E) 14 yrs M	S.H.	5	+
7	R (E) 12 yrs M	S.H.	7	+
8	L (E) 12 yrs M	S.H.	12	+
9	H (R) 10 yrs M	S.H.	8	+
10	W (R) 14 yrs M	S.M.	23	+
11	H (F) 14 yrs F	S.H.	14	+
12	D (F) 13 yrs M	S.M.	5	+



Case No	Name Age Sex	Ova in Urine or Stool	Eos %	Cercarial Skin Test
13	A (G) 12 yrs M	S.M.	6	+
14	H (W) 13 yrs M	S.H.	21	+
15	McM (J) 14 yrs M	S.H.	6	+
16	R (M) 14 yrs M	No	6	+
17	T (R) 14 yrs M	No	10	+
18	B (P) 10 yrs F	S.M.	7	+
19	H (J) 13 yrs M	S.M.	13	+
20	H (D) 11 yrs M	S.H.	15	+
21	S (W) 13 yrs M	No	5	+
22	S (B)	No	4	+ -
23	S (D) 8 yrs M	No	3	-
24	K.G. (I) 14 yrs M	No	1	-
25	L (K) 16 yrs M	No	2	-
26	S (K) 15 yrs M	No	3	+ -
27	T (B) 13 yrs M	No	-	-
28	M (A) 12 yrs M	No	2	-
29	L (R) 15 yrs M	No	7	-

In the cases of 29 children examined by the author for Schistosomiasis during the period Sept. to January 1946, when use of the Cercarial Skin Test Antigen had been released for clinical diagnostic purposes, the importance of this Skin Test with the Eosinophil Counts and presence of ova in urine and stool was determined.

Of this series all cases where ova were demonstrated in either the urine or stool gave positive reactions to the Cercarial Skin Test Antigen, that is 15 cases of the series. The Eosinophil Count in the same cases revealed a definite Eosinophilia in all cases, except three, (Nos 5, 6, and 12).

In cases where ova in urine or stool were absent after repeated examination of specimens, three cases gave a positive skin test and Eosinophil % was 6%, 10% and 5%. Histories of risk of infestation were also given.

Two cases gave a doubtful positive Cercarial Skin Test Antigen. Eosinophil% was 4% and 3% respectively, and both had run risk of infestation.

Nine cases gave a negative skin test with normal Eosinophil Counts and doubtful histories of possible infestation.

SERIES B.    ADULTS    -    RAILWAY EMPLOYEES (male)

Case No	Name Age	Ova in Urine or Stool	Eos %	Cercarial Skin Test
1	G (H.H) 53 yrs	S.M.	-	+
2	C (M.T) 18 yrs	No	9	+ -
3	H (W.A.) 47 yrs	No	3	-
4	L (A.J.C) 49 yrs	No	3	-
5	P (C.S) 55 yrs	No	3	not perfd.
6	S (P.G) 39 yrs	No	4	+
7	A (G.W) 50 yrs	No	4	+
8	M (G.W) 32 yrs	No	26	+
9	G (G.L) 32 yrs	No	8	+
10	W (G) 44 yrs	No	2	+ -
11	McK (WH) 24 yrs	S.H.	9	+
12	M (B) 17 yrs	S.H.	12	+
13	C (J) 25 yrs	No	4	+
14	B (J) 36 yrs	S.H.	4	+
15	R (I) 36 yrs	No	5	-

Case No	Name Age	Ova in Urine or Stool	Eos %	Cercarial Skin Test
16	S (J) 46 yrs	No	4	-
17	H (F) 40 yrs	No	4	-
18	S (J) 24 yrs	S.M.	3	Not done
19	J (W) 18 yrs	S.H.	6	+
20	D (F) 19 yrs	No	4	+
21	N (G) 40 yrs	No	5	-
22	S (J) 52 yrs	S.M.	4	+
23	N (E) 38 yrs	No	4	-
24	R (G) 25 yrs	No	-	-
25	P (J) 55 yrs	No	3	-
26	G (J.F) 18 yrs	No,	1	+ -
27	J (J.H.) 54 yrs	No	8	-
28	B (A.C.) 45 yrs	No	4	+
29	A (G) 45 yrs	No	4	+
30	McG (J) 26 yrs	S.H.	3	+



In the cases of 30 adult male Railway employees whose occupation, particularly the railway staff, drivers, fireman and guards, lends itself to a very definite risk of infestation, were similarly tested over the same period - September to January 1946.

In this series 8 cases who had demonstrable ova in urine or stool also gave positive reactions to the Cercarial Antigen Skin Test, but the Eosinophil Counts did not show a consistent Eosinophilia except in 3 cases (Nos 11, 12 and 19).

In cases with no ova demonstrable in urine or stool seven cases gave + positive skin test, Eosinophil Counts were normal, except in 2 cases, (Nos 8 & 9) which gave a decided Eosinophilia.

Three cases gave doubtful positive tests and one only (No 2) showed Eosinophilia.

Eleven cases gave a negative skin test and all Eosinophil Counts were within normal limits, except in cases No 27 and 28, 8% and 9% Eosinophilia being present. As already mentioned, all cases in this series ran an occupational risk of infestation over a period of years.

SERIES C.      ADULTS      MALE      PRIVATE CASES.

Case No	Name Age	Ova in Urine or Stool	Eos %	Cercarial Skin Test.
1	J (A) 32 yrs	No	1	+ -
2	A (J) 26 yrs	No	-	+ -
3	R (F) 41 yrs	No	-	-
4	McL (N) 39 yrs	No	10	-
5	F (P) 24 yrs	No	10	-
6	S (S.M) 50 yrs	No	3	-
7	B LT-COL 55 yrs	No	4	-
8	B (B) 16 yrs	No	3	-
9	H (F.E) 52 yrs	No	1	+ -
10	S (P) 18 yrs	No	4	-
11	S (N.R) 41 yrs	No	6	-
12	H (R) 36 yrs	No	1	-
13	L (E) 34 yrs	No	1	-
14	M (J.H) 44 yrs	No	2	-
15	McL (J) 40 yrs	No	5	-
16	S.S.(W) 18 yrs	No	5	+

Case No	Name Age	Ova in Urine or Stool	Eos %	Cercarial Skin Test
17	S (J.H.) 34 yrs	No	5	-
18	T.B (F) 53 yrs	No	5	+ -
19	S (D.M.) 24 yrs	No	3	-
20	L (B.A.) 39 yrs	No	5	-
21	W (H) 24 yrs	No	6	+
22	V.M (J) 39 yrs	No	2	+ -
23	McK (E) 20 yrs	No	3	-
24	S (G.A.) 23 yrs	No	2	-
25	L (J.M.) 34 yrs	No	5	-
26	McA (D) 17 yrs	No	4	-
27	C (G) 56 yrs	No	1	-
28	H (A) 40 yrs	No	2	-
29	H (R.N.) 39 yrs	No	8	-
30	O (J.M.) 49 yrs	No	4	-
31	S (W.B.) 42 yrs	No	2	-
32	V.Z (C) 17 yrs	No	4	-
33	D (R.D.) 56 yrs	S.M.	3	+

In the cases of 33 adult males taken from the author's private practice in the same period - September '45 to January '46 - a similar investigation was performed.

In this series only one case (No 33) was found to have ova, that of *S. mansoni*. The Cercarial Skin Test Antigen gave a positive reaction in this case but the Eosinophil Count was found to be within normal limits.

In cases with no ova demonstrable in urine or stool, two cases gave a + positive test. Eosinophilia was absent in both but a history of occupational risk to infestation was given, one being a farmer, the other a Government Surveyor.

Five cases gave a doubtful positive reading. Eosinophil Counts were normal or less and risk of infestation was substantiated in all, and twenty-five cases gave a negative skin reaction. Eosinophilia was present in four cases (Nos 4, 5, 11 and 29) of this series. Risk of infestation was doubtful in these 25 cases.



SERIES D.      ADULTS.      FEMALE.      PRIVATE CASES.

Case No	Name Age	Ova in Urine or Stool	Eos %	Cercarial Skin Test.
1	B. Miss 21 yrs	No	10	-
2	H. Mrs 37 yrs	No	10	-
3	S. Mrs. 23 yrs	No	8	-
4	H. (D) 16 yrs	No	13	-
5	H. Mrs. 18 yrs	No	3	-
6	C. Mrs. 28 yrs	No	1	-
7	W. Miss 18 yrs	No	4	-
8	T. Mrs. 34 yrs	No	4	+ -
9	J. Mrs. 23 yrs	No	7	+
10	L. Mrs. 18 yrs	No	5	+
11	W. Mrs. 18 yrs	No	9	-
12	V. Zyl. 15 yrs	No	2	-
13	C. (S) 17 yrs	No	2	-
14	C. Mrs. 38 yrs	No	2	-
15	S. Mrs. 53 yrs	No	2	-
16	R. Mrs. 24 yrs	No	-	-
17	B. Mrs. 47 yrs	No	-	-
18	McA. Mrs. 19 yrs	No but old	60%	+ -

In this final series of 18 cases of adult female private cases, similarly investigated:- No Schistosoma ova were found in either urine or stool. In one case (No 18) with a previous history of S. mansoni infestation of 3 years ago, a doubtful reaction to Cercarial Skin Test Antigen, and an absolute Eosinophilia was found, being exceedingly high.

Note: Details of this case, No 18, have been added at the end of the discussion.

Two cases gave a + positive response to the Antigen Test and case No 9 had also Eosinophilia. Risk of infestation was doubtful.

Fourteen cases gave a negative response to the Antigen test of which 5 cases had Eosinophilia - Nos 1, 2, 3, 4, 9, and 11. Risk on infestation was unlikely.

Case No 18:

History: - In November 1942, aet 17 years, complained of skin eruptions on body and thighs, abdomen and axillae. Duration 4-6 weeks.

Previous History: Patient had S. mansoni infestation in 1941 and a course of Fouadin intra-muscular injections were given at Bulawayo. Treatment had to be discontinued/

be discontinued owing to painful areas at site of injections. Nil else apart from maxillary antrum infection.

Clinical Examination revealed no abnormalities and all systems appeared organically sound.

I<sub>n</sub> March '43 symptoms of general weakness and debility were complained of.

Examination at this time revealed that the reflexes were hyperactive; anaemia was present; haemaglobin 53%; urine and stool examinations were negative.

5 Campolon injections of 2 ccs. 3 x weekly and haematinic plastules t.d.s. were prescribed and improvement resulted. In December '45 the patient stated that since she had a tooth extracted the gum was very painful and swollen. Progressive weakness and debility was also complained of.

Examination showed that all systems appeared sound, but pain on pressure over appendix scar extending into right groin was evidenced.

Blood Examinations - 30th March 1944 - Red Blood Cells 4,800,000; colour index 0.91; white blood count 48,000; diff. count 86% Eosin.

Subsequently investigation by cystoscopy and sigmoidoscopy were performed in January '44 with negative findings.

O<sub>n</sub> May 5th/

On May 5th, '44, the patient commenced a course of Sod. Ant. Tart. (I-V). There was no sign of intolerance to the drug and grs. 24 were given in  $3\frac{1}{2}$  weeks. A differential blood count taken on completion of treatment showed a 43% Eosinophilia.

On 21st November '44 further investigations by radiological methods were performed. Dr. M. Gelfand, Gov. Radiologist at Salisbury, reported negative findings in Skiagrams of the chest. A full blood count at this stage showed R.B.C's 4,800,000, W.B.C's 35,000, Eosinophils 35%

A diagnosis of Tropical Eosinophilia was made and a course of 6 N.A.B. (Neo-arspenamine) injections was given - 2 injections weekly - 2 of 0.5 gm.s 2 of 1.0 gms. and 2 of 1.5 gms. Differential blood count on completion of the course was 32% and the patient felt very fit.

Subsequent progress of case:

Married Dec. 1944; pregnancy followed and Caesarian section was performed on 24th Sept. 1945, owing to a contracted pelvis.

Blood transfusion 600 ccs. was given following a moderate post partum haemorrhage and the patient has enjoyed good health since.



Differential Blood Counts taken on Case No 18  
between 29.3.44 and 15.12.44.

Date	Total R.B.C's	Total W.B.C's	Diff. Blood Count			
			Nts	Lymphs	Mons	Eos
29.3.44			8	4	2	86
1.4.44	48,000		16	8	2	64
26.6.44			40	25	11	24
27.7.44			40	20	7	33
6.9.44						43
9.12.44	58,600		8	7	1	84
15.12.44	47,000		4	7	1	88

From measurements of the stool...  
and the histological picture...  
of the stool... Due to the...  
of S. paratyphi infection...  
this case was further investigated...  
sigmoidoscopy with negative findings...  
of Typhoid Bacillus...  
In the cases...  
In series A, three children...  
Rosinophilia and history of risk of...  
Two/

SUMMARY:

In series A, 2 children were examined with urine and stool examination, Eosinophil Counts, and Cercarial Skin Test Antigen.

15 cases with ova demonstrable, gave raised Eosinophil Counts and + positive Skin Tests.

In series B, 30 adult male Railway employees were similarly investigated. 8 cases had ova demonstrable in either urine or stool. All gave a + positive skin test, but Eosinophil Counts did not show a consistent rise. Cases Nos. 11, 12 and 19 alone had percentage counts above normal limits.

In series C, 33 adult male private patients were similarly investigated. Only one case was found to have demonstrable ova, the case gave a positive skin test and the Eosinophil count was normal.

In series D 18 adult private patients were similarly investigated. None showed demonstrable ova in urine or stool.. One case (No 18) with a previous history of S. mansoni infestation was found to have a very high Eosinophilia and a doubtful skin test reaction. This case was further investigated by cystoscopy and sigmoidoscopy with negative findings and a diagnosis of Tropical Eosinophilia was finally made.

In the cases where ova were absent in urine and stool:-

In series A, three children gave positive skin test, Eosinophilia and history of risk of infestation.

Two/

Two children gave doubtful skin test, normal Eosinophilia Counts and risk of infestation, and nine children gave negative skin test, normal Eosinophil Counts and possible risk.

In series B, seven cases of Railwaymen gave positive skin test, and normal Eosinophil Counts, except in 2 cases where Eosinophilia was present. Three cases of Railwaymen gave doubtful skin test - one only had an Eosinophilia, and eleven cases of Railwaymen gave negative skin test - two only had an Eosinophilia. All these cases ran an occupational risk of infestation.

In series C, two cases gave a positive skin test, normal Eosinophil Counts and risk of infestation. Five cases gave a doubtful skin test, normal Eosinophil Counts and risk of infestation, and twenty-five cases gave a negative skin test, Eosinophilia was present in 4 cases only, and risk of infestation was doubtful.

In series D, two cases gave a positive skin test, both had Eosinophilia and risk of infestation was unlikely. One case gave a doubtful skin test, a very high Eosinophilia, and a history of old *S. mansoni* infestation of 4 years duration, and fourteen cases gave a negative skin test, five of whom had an Eosinophilia. The risk of infestation in all these cases was very improbable.

Series Group.	Ova +	S. T. +	Eos +	Ova -	S. T. +	Eos -	Ova -	S. T. +	Eos -	Ova -	S. T. -	Eos -
A (19 children)		15		3				2			9	
B (30 Railwaymen)		8		8				3			11	
C (33 male private cases)		1		2				5			25	
D (18 female private cases)		-		2				2			19	
Total of all cases		24		15				12			59	
Groups A to D												
110												

Guide Note:

Ova + means: Ova S. haematobium or S. mansoni present.  
 S.T. + Cercarial Skin Test Antigen Positive  
 Eos + Eosinophilia.  
 Ova - No ova of S. haematobium or S. mansoni present.  
 Eos ± Normal Eosinophil Count or Eosinophilia.  
 S.T. +- Cercarial Skin Test Antigen Doubtful.  
 S.T. - Cercarial Skin Test Antigen Negative.



CONCLUSIONS:

In a review of the cases in the series A, B, C, and D, it is apparent that:-

1. The demonstration of ova in urine and stool is positive evidence of the disease; that in such cases the Cercarial Skin Test Antigen gives a positive reaction in every case, and that the Eosinophil Percentage Count is not a completely reliable test in such cases.
2. Absence of ova in urine and stool in a case does not necessarily imply freedom from the disease as such cases do not always give a negative Cercarial Skin Test Antigen Reaction, nor is the Eosinophil Percentage Count always within normal limits. Should, however, the Cercarial Skin Test Reaction be a negative one, and the Eosinophil Count is normal, then it is practically certain the case is not one suffering from Schistosomiasis.
3. Absence of ova in urine and stool in a case giving a positive Cercarial Skin Test Antigen may or may not mean the presence of Schistosomiasis, even with an Eosinophilia.
4. The absence of ova in urine and stool in a case giving a doubtful Cercarial Skin Test Antigen Reaction may or may not mean the presence of Schistosomiasis, and that/

and that, with or without an Eosinophilia.

In cases complying with categories 3 and 4, further intensive investigations are called for by cystoscopic and sigmoidoscopic examinations as well as further examinations of urine and stool specimens, etc. From this examination and analysis the author concludes that:-

The children in S. Rhodesia are very liable to infestation by Schistosomiasis.

The employees on the Rhodesian Railways in the course of their occupation run a very grave risk of becoming infested, and

The men and women engaged in their ordinary pursuits of life in cities of S. Rhodesia are the least likely subjects to fall victim to the disease.

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