# AN EPIDEMIC OF KALA AZAR

# IN KENYA.

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In September 1951, the writer was posted as Medical Officer of Health in charge of Kitui District, at that time part of the Central Province of Kenya. For the next year, his time was taken up with the organisation of the curative and public health services of the district. Cases of Kala Azar were admitted to hospital from time to time and were regarded as cases of great interest. It was felt that it would be a good thing to do something about eradicating the disease, but while the numbers of patients suffering from kala azar remained small, a programme to eradicate the disease, while laudable, would hardly be worth the cost. This was the state of affairs till September 1952, when the incidence of kala azar began to increase enormously. After reaching an incidence of three hundred and twelve new cases in April 1953, the incidence fell off to a steady seventy cases a month in 1954, until, at the end of the year, it fell to about twenty cases a month. In the first four months of 1955, it continued at this low level and at the end of that time, the writer proceeded on leave. Thus the writer saw the whole epidemic, since at the time of his departure from the district, it had fallen off to almost negligible proportions.

In all from the beginning of the epidemic till the end of 1954, three thousand and seventy one cases

of kala azar were treated. Apart from a period of seven weeks, when another medical officer was in charge of two centres where patients were treated and which were visited frequently by the author, the author was in entire charge of the management of the epidemic. The curative side of the outbreak was in charge of the writer, while the investigation of the vector was undertaken by The Division of Insect Borne Diseases, Kenya. Because of this division of responsibility into two distinct sections, the first being curative and in charge of the writer and the second being the investigation of the vector, the writer had nothing to do with the investigation of the causes of the outbreak. For this reason, and since it is understood that the subject of the vector is likely to be the subject of another publication by another writer, there is nothing in this thesis about the vector. Secondly, since the number of cases of kala azar was high and the preparation of statistics regarding physical signs and laboratory investigations would have been excessively laborious, if all the cases had been considered. Five hundred cases were picked out at random and statistics on these subjects worked out from them. It is considered that the series of five hundred cases is representative of the entire epidemic. When such matters as the incidence of the disease and death rate are under consideration, the figures relating to the entire epidemic have been used.

PHYSICAL CHARACTERISTICS OF THE DISTRICT AND ETHNOLOGY.

Geography:

Kitui District consists of a roughly diamond shaped area of land lying between the equator and 3° south and between 38° and 39° of east longitude. The Kitui Native Land Unit is also roughly diamond shaped and consists of approximately 6,000 square miles in area within Kitui District. The Land Unit is bounded in the north west and north by the Tara River, which separates it from Embu and Meru Districts and in the south west by the Athi River which is the boundary with Machakos District. To the east of the Land Unit lie the Eastern Crown Lands, a virtually uninhabited and waterless, hot region which stretches away towards the Kenya Coast. The entire population lives within the Land Unit, which will be referred to as the district but, strictly speaking, Kitui District consists of the Land Unit plus the rather useless Eastern Crown Lands. In the centre of the District there is a roughly circular area of an altitude of 2,800 to 4,200 feet. Round this central dissected plateau which has a diameter of fifty miles the land is of considerably lower altitude - 1,700 to 2,500 feet. The eastern side of the plateau terminates in an escarpment, where there is a sudden drop of 2,000 feet, but to the north and south, the change in altitude is more gradual. This area of lower altitude is the shape of a reversed "C" (i.e.Ↄ), the


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arms enclosing the plateau. It contains several ranges of hills, notably Mumoni, Endau and Mutha, which run in a north to south direction. The Tana and Athi Rivers, which are both boundaries of the district, are the only permanent rivers in the area, but the entire country is dissected by sand rivers which flow for short periods during the rainy seasons and where water can be obtained during the dry seasons by digging.

Geologically, the district is made up of granite and igneous rock, covered by laterite to a variable depth, but very thinly in general. In the north and east, the soil tends to be more sandy.

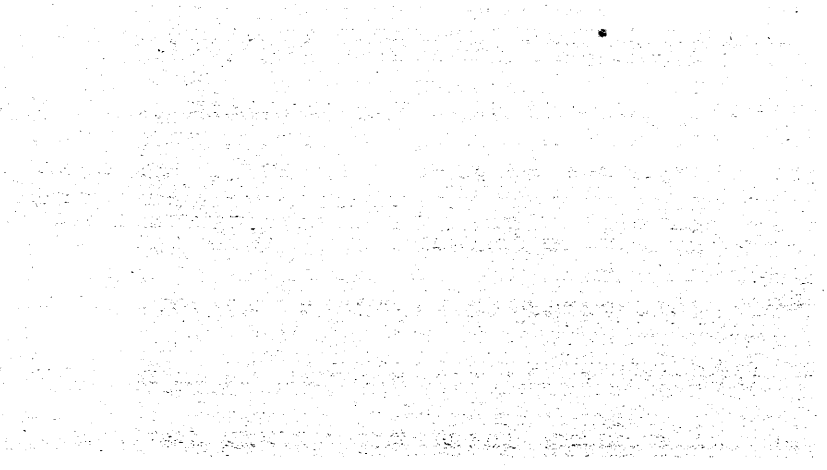
Vegetation varies with the altitude and its consequent effect on the climate. In the plateau where the climate is of the Mediterranean type, grass cover is good - where it has not been destroyed by overgrazing and overcultivation, and while the natural tree growth is thorn scrub, most of it has been cleared for the cultivation of the staple crops which are good. Mangoes, paw paws, guavas and citrus are grown and European vegetables and flowers can be grown with difficulty in the plateau area. On the other hand, in the low-lying land off the plateau, there is poor grass and much erosion. The country consists of thick bush, broken up by sand rivers and occasional small

areas of cultivation. The crops in this part of the district are poor. Scenically, the plateau is rather pleasant, hilly, agricultural country, but the low-lying area is dull, rolling, thick bush, green in the rains and grey during most of the year, dominated by numerous baobab trees and with views of distant mountains.

Climate depends on altitude and vegetation. At Kitui Township, the administrative centre on the plateau, an equable Mediterranean climate prevails, but in the low country the climate approximates more to that of a desert. In Kitui Township, temperatures below 55° are uncommon or rises above 90°. In the hotter low country, temperatures do not commonly exceed 105°. Rainfall varies very considerably from place to place, but in general the plateau gets about 40 inches in the year and the low country about 10 to 15 inches. Failure of the rains in the low country is common e.g. Tseikuru Location in the north of the district near the Tana River at an altitude of 1,750 feet got only 4 inches of rain in 1953. Rain falls in two rainy seasons, during the short rains in the months of April and May and during the long rains in October, November and December. In the plateau, one third of the rainfall occurs during the short rains and two thirds during the long. In the low country there tends to be rainfall in similar proportions, but as previously stated,

failure of the rains is very common. Rain, unfortunately, tends to be torrential instead of gentle and this, coupled with poor grass cover due to overgrazing, results in considerable loss of water which in less desert conditions would remain in the soil and improve its fertility.

To sum up, the district consists virtually of two parts, firstly a small plateau with a pleasant climate, reasonably adequate rainfall and with moderately fertile agricultural land and secondly a large surrounding tract of low lying country which is much hotter and drier and where crops are produced with difficulty or not at all.



POPULATION.

The population of Kitui District in 1948 was 211,000.

Ethnology:

The district is inhabited by a Bantu tribe called the Wakamba and is one geographical half of the Kamba Reserve, the other half being Machakos District, which is looked upon as the paramount half of the entire reserve. To the north and north west lies the Kikuyu Reserve inhabited by Kikuyu and two branches of the tribe, the Embu and Meru. The Masai Reserve is to the south, inhabited by the Nilo-Hamitic Masai. On the east are the Nilo-Hamitic Galla, a scanty pastoral nomadic tribe.

As the Wakamba have no written history is is difficult to be certain of their origin, but there is a tradition that they came from Tanganyika and settled first at Machakos and went thence, probably about 200 years ago to Kitui. What is certain is that a hundred years ago they were settled on the plateau at the time of Dr. Krapfs' visit in November 1849. They obtained possession of the district from the Galla and they held it against Kikuyu and Masai raids till the advent of the British at the end of the 19th century. An old Arab slave route into the interior passed through the western part of the district, in order to avoid

the warlike Masai, but there are no records of the people before the visit of Dr. Krapf.

Physical Characteristics:

Physically they are a sturdy people. The men are of an average height of 5 feet 6 inches and are strong and well developed. They tend to be brown in colour rather than black like the Jaluo. Their features are good by European standards, with well cut noses and thin lips. In the outlying parts of the district, one still sees the practice of removing the lower incis or teeth as a protection against the trismus of tetanus. Tatooing is employed as a form of personal adornment and scarification between the breasts is common in women, who do this to prevent their breasts becoming pendulous. Circumcision is performed on both sexes, but is not a important ritual leading to fellow affinity and age groups as among the Kikuyu, but is performed about the age of seven or eight years. Living as they do in a poorly watered district, personal hygiene is generally of a very low standard.

Customs:

Polygamy is practiced, wives being bought with cattle, sheep and goats. Divorce is not common. Children are numerous. By European standards, their standard of morality is low. Illegitimacy is common. Marital fidelity is not important.

With regard to occupation, most men own flocks of cattle, sheep and goats and their principle wealth is in livestock, which they are most unwilling to sell, preferring to eat an animal after it dies rather than to slaughter it for food. In addition most men own shambas, small fields by European standards, where they practice a form of agriculture which depends largely on the rainfall. On the plateau, crops of maize and millet are good and surpluses are produced, the sale of which yields commodities which improve their standards of living. In the low country, crops are generally poor and there are no surpluses. There is generally a period of scarcity of food just before and during the rains, before the next crop matures. The only food crop grown in the areas of lower altitude is millet. Ricinus is grown as a cash crop over most of the district. Until recently there was no artisan class, but there is growing up a small class of artisans who are reasonably competent at carpentry, bricklaying, tailoring and such-like trades. As is common in E. Africa, women do most of the work, but they are not worked as hard as Kikuyu women. Women do all the work of the fields, while the men and boys, usually the latter, attend to the work of herding the livestock. Prior to the suppresion of inter-tribal warfare by the British, the men were engaged largely in fighting. As it is, they do very little and sit

around talking interminably and drinking. They are an incredibly lazy people, who keep their self respect by talking about what should be done rather than doing it. Soldiering is very popular and large numbers of men join the King's African Rifles. Great reverence is paid to the old men who are the guardians of tradition and the disciplinarians. They are an incredibly litigious people and will go to their own courts over small matters, such as very trivial injuries, minor trespass and the like. Their religion is a loose sort of thing with certain sacred places and sacred trees where it was customary, and in places still is, to make sacrifices to spirits or a rather vague sort of god. They have no priests other than the witch doctors, who do a two-fold job - the cure of diseases and the imposition and removal of curses and spells. They are very superstitious and acutely afraid of the witch doctors.

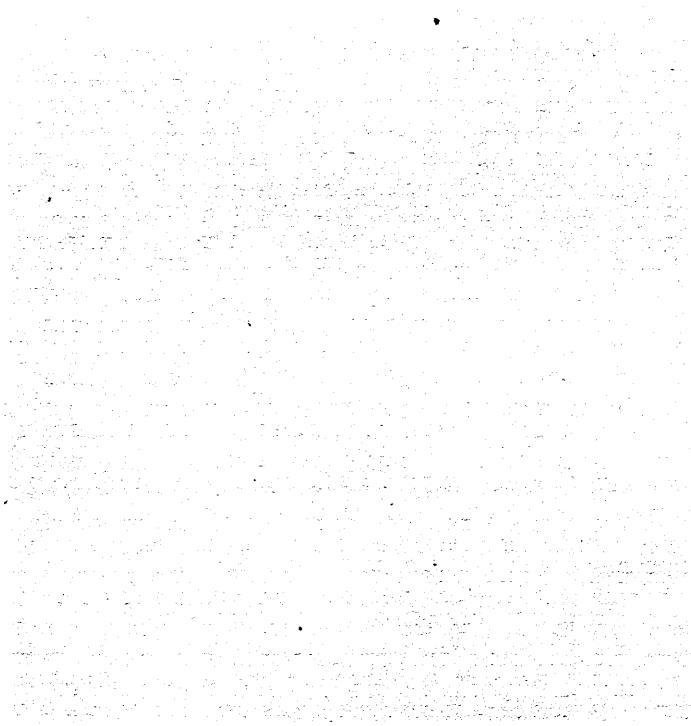
For weapons, they use bows and arrows, and if they can avoid Governmental notice, an arrow poison derived from an Acocanthera species. This poison is very effective and, if fresh, will kill a man within twenty minutes. The results have been seen by the writer. Ivory poaching is common in the south of the district, which borders on the Tsavo Game Reserve, part

of which lies in the Eastern Crown Lands.

Since in general the land is poor and the grass poor due to overgrazing there has been no tendency to form large village groups. Almost the entire population lives in small villages which consist of two or three huts and a grain store or two. These villages are perhaps a quarter of a mile apart or further and in the near vicinity are a few small unfenced fields where millet, and on the plateau, maize are grown. Livestock are pastured near the village by the boys and young men. Their houses consist usually of grass-thatched mud huts, but in the north, the entire hut is commonly made of grass. Markets are scattered throughout the district - every ten or so miles and there the people can buy simple commodities such as clothing, beads for ornament, salt, maize etc. in exchange for hides and skins and any surplus crop which they have produced.

These conditions are modified by two factors, namely, the activities of the various missions and by education. Missionary influence does not extend very far from the vicinity of the mission, but it does reduce drunkenness, polygamy and immorality in that vicinity. The missions have tended to counteract the influence of the witch doctors and have tried to suppress dancing, which is very popular. Education

has resulted in a raising of the standard of living, as have the missions, but the percentage of those who have been to school or have come under mission influence is very small, if compared with the size of the population. Neither of these influences have been of much strength in the area of the district involved in the kala agar epidemic.



MKAMBA WOMAN PREPARING UJI.

For food, on the plateau in general and among the European influenced members of the population elsewhere and those who have been to school or mission or who are Government servants, they eat millet and maize, as their staples, occasionally supplemented by meat, milk, pulses, vegetables and fruit such as mangoes and papaya. At lower altitudes where the only crop which will grow is millet, it is the staple and is usually taken as a gruel called "uji", which is made by grinding water-soaked millet between stones. This monotonous staple diet is invariable. Maize is well liked, but has to be bought since it won't grow. The staple is supplemented by milk and by whatever else is available - the meat of a cow which dies, a buck which has been shot by the hunter, birds such as guinea fowl, locusts in season, flying ants, fruit of the baobab tree as a sherbet. Despite this apparently poor diet, kwashiorkor does not occur among the Kitui Wakambas as it does among their neighbours the Wakikuyu who inhabit a much more fertile country. With all the dirt and ignorance, marasmus is common in young children.

Prevalent Diseases:

The district is unhealthy and disease abounds. Malaria is endemic, with mild epidemics at the beginning of each rainy season. Venereal disease is rife, especially in the south of the district, whence

considerable numbers of men go to employment in Mombasa. Schistosomiasis is common on the plateau and along trade routes - both S.haematobium and S.mansoni occurring. In view of the poor standards of hygiene, amoebiasis and intestinal helminthiasis are common, but there is little hookworm, due to the low humidity of the district. Yaws occurs, especially in the north and east of the district, but treatment is effectively stamping it out and it is no longer a serious problem. Leprosy, usually tuberculoid is not uncommon especially in the south.

The picture is one of a rather primitive lazy and rather drunken tribe, sparsely distributed over an arid district, living on a poor diet and not far from famine in the event of failure of the rains. But if this picture is depressing, while lazy and quarrelsome, they make excellent soldiers and are loyal to the Government. While usually dirty, they are so from necessity rather than choice. While ignorant and superstitious they grasp eagerly at the opportunity of educating their families and while in the hands of the witch doctor for trivial illnesses, they will seek proper medical treatment for more serious ones. They are cheerful and have a strong sense of humour. Unlike some of the Kenya tribes today, they welcome one to their villages. Altogether they are a rather likeable people.

MEDICAL ORGANISATION.

Before going on to consider the previous incidence of kala azar in East Africa and in the District it would be as well to consider the medical organisation of the district.

The administrative centre of the district where all the Government offices are is at Kitui, a township on the plateau. There is a ninety-seven-bedded Government hospital there, run by the Medical Officer of Health, assisted by an Asian Assistant Surgeon and a European Nursing Sister. The rest of the staff consist of Africans, about sixty in number and many of them highly trained and doing jobs such as those of laboratory assistants, compounders, hospital assistants, the latter in charge of the out patient department, clerks, health assistants and dressers. The remainder of the staff consisted of cooks, garden boys, sweepers and other minor jobs. This hospital, the only one in a district just slightly smaller in area than Wales provided one bed per 2000 of the population, but since transport facilities in the district were poor it virtually provided medical facilities for roughly a fifty mile radius round the Township and people who required medical treatment outside this radius went to the district dispensaries, whence, if seriously ill, they would be sent into the Kitui Hospital. There were eighteen of these

dispensaries in the district, spaced roughly twenty miles apart and sited at Locational Centres. Locations are governed by Chiefs and at each centre there is a school, a dispensary, a tax office and a rest house for Government officers on safari. The eighteen dispensaries are staffed with a dresser and porter each and nine of them have beds - four to eight each - where patients may be kept for a few days. The value of these dispensaries depends largely on the dresser in charge. A keen dresser will do good work and will be of considerable benefit to his location, a poor one might as well not be there. Their principle work was the treatment of malaria, yaws, pneumonias, dysenteries, ulcers, ophthalmia and trachoma, and wounds. Serious cases were sent into Kitui.

These dispensaries were visited routinely by the M.O.H. on safari, but in view of the size of the district and the amount of both medical and administrative work at the Kitui Hospital it was not possible to visit all of them each month, though this was the aim.

This medical organisation worked quite well and as an example of the amount of work, in 1954 just over 180,000 people were treated by these services, that is the Kitui Hospital, the dispensaries and clinics held by the medical officers on safari.

SUMMARY:

An attempt has been made to present a picture of the district, of its people and of the medical organisation prevailing at the time when the kala azar epidemic first occurred.

PREVIOUS INCIDENCE OF THE DISEASE.

The incidence of the disease in East Africa as a whole and in Kenya in particular has already been most adequately dealt with by Fendall in his paper "Kala Agar in East Africa with particular Reference to Kenya and the Kamba Country" who points out an increase in incidence in Kenya "a total of four cases 1932-39 inclusive, 34 cases during the war years 1940-45 and 76 cases in the post-war years 1946-50 inclusive". In all 35 cases were discovered in Kitui District between October 1948 and September 1951, despite a vast amount of field work in looking for them. There is no doubt that while the disease was occurring in the Ktui District, the incidence was exceptionally small.

In 1951, 13 cases of the disease were seen and in the first eight months of 1952 11 cases.

OUTBREAK OF THE EPIDEMIC.

As pointed out the incidence of kala azar in Kitui District was small in the years prior to 1952. Eleven cases were admitted for treatment from the north of the district during the first eight months of the year and there was nothing to suggest that an enormous increase in incidence was about to occur.

At the end of August 1952, I received a letter from the Dresser in charge of Tseikuru Dispensary. Tseikuru is a locational centre 106 miles north of Kitui Township, situated in the low bush country 16 miles south of the Tana River and at an altitude of 1,750 feet. The dresser informed me that he had recently seen about two hundred cases of kala azar and asked for permission to send them into Kitui Hospital, which incidentally has 97 beds. While this dresser had seen a few cases of kala azar, discovered by my predecessor, on kala azar surveys, I felt that he must be wrong. The most diligent search by my predecessor had yielded only 35 cases, so I considered it likely that he was mistaken and was confusing the splenomegaly of kala azar with splenomegaly due to some other cause such as malaria. Since the advent of the early missionaries with salvarsan and the apparently miraculous effect of one injection on cases of yaws, injections have been

held in great regard by East Africans and nowhere more so than in Kitui District. My predecessor, on his Kala azar surveys, had done a large number of spleen punctures while on safari and these had been much appreciated, the "recipients" claiming to have benefited from them considerably. I had been asked frequently while on safari in the outer parts of the district for "spleen injections", so knowing their popularity, I thought that it was likely that the Tseikuru people had decided that they would like to have spleen injections and had put the dresser up to indicating a need for them. These considerations made me decide that his statement about having seen 200 cases of kala azar was nonsense and having a full safari programme already fixed for the month of September 1952, I am ashamed to say I did nothing about it, filing his letter and reflecting that it would probably be necessary to move the dresser to some other dispensary.

During September 1952, however, seven cases, six male and one female, of kala azar came from the north of the district. All gave a history of having been ill for four to six months. All were typical cases of kala azar and all had positive spleen punctures. Three were adult males from Mivukoni Location, which is south of the Tseikuru Location. There was one male

adult, a male child, and an adolescent from Tseikuru and one adolescent female case from Tharaka Location, which lies on the Tana River to the west of Tseikuru.

In October, fourteen male cases were admitted to the Kitui Hospital. All were males and all had positive spleen punctures. Their age groups and origins were as follows:-

Males.

| | 0-3 yrs | 3+ yrs | 9+ yrs | 18+ yrs |
|---|---|---|---|---|
| Mivukoni Location | 0 | 3 | 0 | 2 |
| Tseikuru " | 0 | 1 | 2 | 4 |
| Ngomeni " | 0 | 0 | 0 | 1 |
| Nuu " | 0 | 0 | 0 | 1 |
| Totals | 0 | 4 | 2 | 8 |

By the end of October it was obvious that there was an increased incidence of the disease in the north of the district. Records showed that twenty three cases of kala azar had been diagnosed in Kitui Hospital from 1940 to 1950, yet in the months of September and October 1952, twenty one cases presented themselves. Tseikuru and Mivukoni were consequently visited at the end of October and seventy six people found to be suffering from kala azar. These were typical clinical kala azar, emaciated and febrile, with grossly enlarged livers and spleens, with generalised enlargement of lymph glands, with gross clinical anaemia and several with oedema. As the Kitui Hospital was pretty full at the time, I arranged

to take patients into hospital in weekly batches, hoping to be able to clear out other less serious cases in order to make room for them. The position was reported to Medical Department Headquarters at Nairobi.

From all points of view the position was now pretty serious. Ninety seven cases of kala azar had been discovered in two months and in view of the fact that the part of the district where they came from is exceptionally primitive it was likely that very many cases had not yet come forward for treatment but were in the hands of the witch doctors. I estimated that there might be about 300 cases requiring treatment.

Diligent search of the textbooks and publications gave little help or advice on how to deal with an epidemic of kala azar. There is no known prophylaxis - an American military manual advises avoidance of the area!

There were several considerations which led to the decision to treat cases in their locations rather than bringing them all into Kitui Hospital.

(1) Firstly the Kitui Hospital had only 97 beds and they were only enough for general purposes without turning them over to kala azar cases. Of course it might have been possible to increase the number of beds at Kitui, but this increase would have to take place very rapidly in order to accomodate the cases.

It would have been easier to build temporary mud and wattle buildings in the north where ant-proof wood poles can be cut than at Kitui where they are not available.

(2) There was the problem of transporting the cases to Kitui. Tseikuru is 106 miles from Kitui and there is only one bus a week. Bus transport would have been expensive and the only other transport available was one ambulance.

(3) An important factor was the public health one of trying to keep the outbreak localised in the area in which it occurred. Sandflies occur all over Kitui District and there was a distinct possibility that if all cases were treated at Kitui Hospital, there might be a massive outbreak in the centre of the district. There was no reason for thinking that the disease would be limited by altitude since fourteen cases of kala azar had occurred in Machakos District between 1942 and 1950 at altitudes of 3,500 to 4,500 feet, that is, at the same altitude as the Kitui central plateau.

(4) The last and a very important factor lay in the patients themselves. The people of Tseikuru, Mivukoni, Tharaka and Ngomeni Locations are perhaps the most primitive in the district. At the time of the onset of the epidemic they went usually to the

witch doctors for treatment of disease and their only contacts with European medicine were when they came to see the medical officer on safari for treatment for specific diseases such as yaws, syphilis and gonorrhoea. They were prepared to come forward for treatment which involved one or two injections, but many of them were quite unwilling to spend long periods in the Kitui Hospital and if asked to do so would usually abscond from the hospital. In view of the fact that the treatment of kala azar is, or rather was, a long business it seemed preferrable to treat the cases in their own locations where they could see and be seen by their friends and relatives. This at least offered some hope of reducing their intense suspicion of hospitals.

For these reasons it was decided that it would be wise to try to treat cases in their own locations. During the month of November, cases continued to come in from the north as follows:-

| | | Males | | | | Females | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 0-3 | 3+ | 9+ | 18+ | 0-3 | 3+ | 9+ | 18+ | |
| Tseikuru | Location | - | 2 | 4 | 15 | - | 3 | 1 | 1 | 26 |
| Nuu | " | - | 1 | 3 | - | - | - | - | - | 4 |
| Katse | " | - | - | - | 1 | - | - | - | - | 1 |
| | | | | | | | | | Total | 31 |

In addition there was one adult male case from Meru District. This man, who gave a positive spleen

puncture, was rather important. He lived in Meru District just across the Tana River from Tseikuru Location and had crossed frequently to the Kitui side. It was likely that he had been infecting the sand flies in Meru District, so it was probable that we would soon receive cases from there. It is noteworthy that while 67 cases of kala azar had been seen on safari at Tseikuru and Mivukoni and arrangements had been made for them to come into the Kitui Hospital during the month of November, only 31 had bothered to come in - proving my point that hospitalisation one hundred miles from the locations was not popular with the people of the distant locations.

Summary:

I have described how from a low incidence of 23 cases between 1945 and 1951 and 13 cases in 1951 and 11 cases in the first eight months of 1952, in September 1952 seven cases, in October 14 cases, and November 32 cases were admitted to the Kitui Hospital for treatment. Secondly, the considerations which led to the decision to treat cases in the locations rather than in Kitui have been discussed.

TREATMENT AT THE TREATMENT CENTRES.

It was decided to treat cases in their locations, reserving treatment at Kitui for the most seriously ill either by reason of the disease or by reason of complications. This was the intention and in general cases in the north were treated there but a small percentage continued to come into Kitui and since the cost of transport was high, were treated there rather than being sent back to their locations.

At the beginning of December 1952 an extra hospital assistant and two graded dressers were posted to the district. Hospital assistants are Africans who have had five years training at the Medical Training School in Nairobi. In addition to nursing training, they receive instruction in anatomy, physiology, therapeutics, medicine and surgery. They are more than nurses and less than doctors and in district hospitals such as Kitui they are employed in such jobs as being in charge of the out-patients department, running wards and clinics and on occasions giving anaesthetics - all, of course, under medical supervision. They are generally thoroughly reliable and are the mainstay of the hospital. Graded dressers have had only two years of training and are generally employed in charge of wards or operating theatre. They are capable of carrying out instructions to the

letter but not of making decisions regarding treatment as are hospital assistants. With these three men plus ungraded dressers from Kitui Hospital it was possible to begin treatment at Tseikuru and Mivukoni. These two places are eight miles apart being 106 and 98 miles respectively from Kitui Township. Both have large bedded dispensaries, each having accommodation for five male inpatients and five female inpatients, in addition to a treatment room each, waiting verandas and dressers quarters. Since these buildings, measuring only fifty feet by forty feet, were obviously not large enough to accommodate the patients, Mivukoni School and Tseikuru School were taken over for use of the patients. Both schools were identical, each consisting of three rooms measuring twenty feet by twenty five feet. The dispensaries were kept for use as dressers quarters and laboratory and treatment rooms. Latrines were available at both places and at that time water was available in the school and dispensary rainwater tanks.

During November, the Nursing Sister at Kitui was busy sorting out the hospital equipment and making available as much as possible for Tseikuru and Mivukoni. £80 of available money belonging to the Kitui African District Council was spent on such commodities as blankets, cooking pots, lamps, maize

meal, beans and salt and at the end of November, all this equipment and food was moved up to Tseikuru and Mivukoni Dispensaries.

With the equipment at Tseikuru and Mivukoni the Medical Officer and African Staff, consisting of one hospital assistant, a laboratory assistant, two graded dressers and three ungraded dressers went up to these places. Patients were examined at Mivukoni and at Tseikuru and kala azar cases sorted out from those who were not suffering from the disease. Three days were spent in sorting out the cases, and at the end sixty eight people commenced treatment, fifty one at Tseikuru and seventeen at Mivukoni. All were clinically very obvious kala azar and while it would have been very satisfactory to have spleen punctured all cases and although I had already done a fair number of spleen punctures at Kitui I was more concerned in getting treatment going than in doing spleen punctures on all cases, for I felt that one death due to rupture of the spleen would imperil the whole experiment of treating kala azar at the two dispensaries. As it was 32 spleen punctures were positive out of 40 performed. But it would be unfair to infer from this that 32 had kala azar and 8 hadn't because frequently one gets a needle-full of local anaesthetic from the abdominal muscles or a syringe-

full of blood from the spleen instead of spleen tissue and juice. Napiers' Aldehyde Test was done on all cases except very young children with small veins.

On 5.12.52, cases had been sorted out when a difficulty arose. These people had been used to coming to see the Medical Officer on safari and getting one injection for yaws or venereal disease and then returning to their homes. They were consequently upset to hear that the course of treatment would take perhaps eighty days to complete. I spoke to them telling them of the necessity for prolonged treatment and warning that intermittent treatment would not do. I remember one woman asking what her husband would say if she were not at home to attend to the house and the fields. I told her that surely her husband would be better off in eighty days time with a fit wife than with a dead wife and well planted fields, but she went off with a shake of her head. Several people refused to stay, but sixty eight remained. A further difficulty arose when it came to feeding the people. Food had been issued to all of them and they were sitting in the schoolrooms,where they were to sleep,with their food and refusing to eat. When I enquired about this I was told that they were afraid to eat in case one of their number was a witch doctor or witch and had put a spell on the food.

This was only countered by eating some of the food myself and getting my African staff to eat with them. These are examples of the primitiveness of these people.

Conditions were rough and ready. The aim was to provide treatment, food and shelter only. There were no facilities for anything else. Beds were not provided except for the very sick, but the patients who did not possess blankets, usually used as clothing were issued with one each. The not so sick had to sleep on the concrete floors of the school or outside in the bush.

Treatment was started on 6.12.52, all patients receiving intramuscular pentamidine isethionate - 0.2G daily for 10 days for an adult, the dose being suitably reduced for smaller children.

The diet at that time consisted of the following:-

| | |
|---|---|
| Maize Meal | 12 oz. daily. |
| Beans | 4 oz. daily. |
| Ghee | ½ oz. daily. |
| Salt. | |

It was then impossible to get fresh meat for the patients. This was obviously an unsatisfactory diet, but I hoped that if supplemented by their own indiginous mawele - gruel made with millet - it would not be deficient in protein. Vegetables were unprocurable.

The Laboratory Assistant was instructed to

perform aldehyde tests on all new cases admitted by the Hospital Assistant in addition to white blood counts, differential counts, haemoglobin estimations and blood slides for malaria parasites. The Hospital Assistant was instructed to see that cases had their pentamidine courses and to keep general order. I returned to Kitui on 6.12.52, having to attend to the Kitui Hospital and the public health of the district in addition to kala azar.

At the same time, orders were given for the construction of huts at Mivukoni and Tseikuru. One measuring sixty feet by twenty feet was completed at each place by the middle of January 1953. Kitchens were also built at the two places. The walls of these buildings were constructed of ant-proof poles and dried mud and all were thatched with grass. The work was communal labour, done by the people of the location on the order of the District Commissioner. On completion of these buildings, a further two similar huts were ordered at Tseikuru and one more at Mivukoni.

In all, 97 cases were admitted for treatment during the month of December, bringing the total for the last four months of the year to 149 cases consisting of 106 males and 43 females. In January 117 males and 37 females, a total of 154 cases, were admitted for treat-

ment. Thus in the months of December 1952 and January 1953, 251 cases were admitted. To meet this enormous influx of patients an increase in staff was necessary. A Medical Officer Dr. John Wray, was appointed to take over the full time running of the two treatment centres at Tseikuru and Mivukoni, but it was found that treatment was of such a routine nature that the presence of a full-time medical officer was not essential. He was posted to another district on 5.3.53. At the end of January 1953, an Assistant Hospital Superintendent, Major Penrose, was appointed to assist in the administration. He, being a practical man, made very great improvements. Water was now very scarce, the tank supply having been used up and it was necessary to bring water from the Tana River 16 miles away, a costly business which did not provide an adequate water supply. Major Penrose, shortly after his arrival at Tseikuru obtained a local supply of water by sinking a shaft into a nearby dried-up river-bed and later, when this was likely to be destroyed by flood water in the rains, by sinking a well on the river bank. This well provided an unfailing supply of water, which however contained magnesium sulphate, a useful thing for Africans who tend usually to be constipated, but a trifle trying for the resident and visiting Europeans! Major Penrose's second improvement


OHMS
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was the concreting of the floors of the mud and thatch huts. Patients sleeping on the earth floors complained that they were being bitten by insects at night. Despite attempts to get one, a specimen was never obtained, but it was suspected that patients were being attacked by the Congo Floor Maggot Auchmeromya. Concreting of the floors with cement and locally produced lime, made by burning limestone, put an end to this trouble. Thirdly Major Penrose's arrival coincided with the arrival of a refrigerator. More adequate supervision plus facilities for storing meat made it possible to include meat in the patient's diet on a ration of at least half a pound of meat daily. One goat or sheep provided enough meat for about twenty people daily.

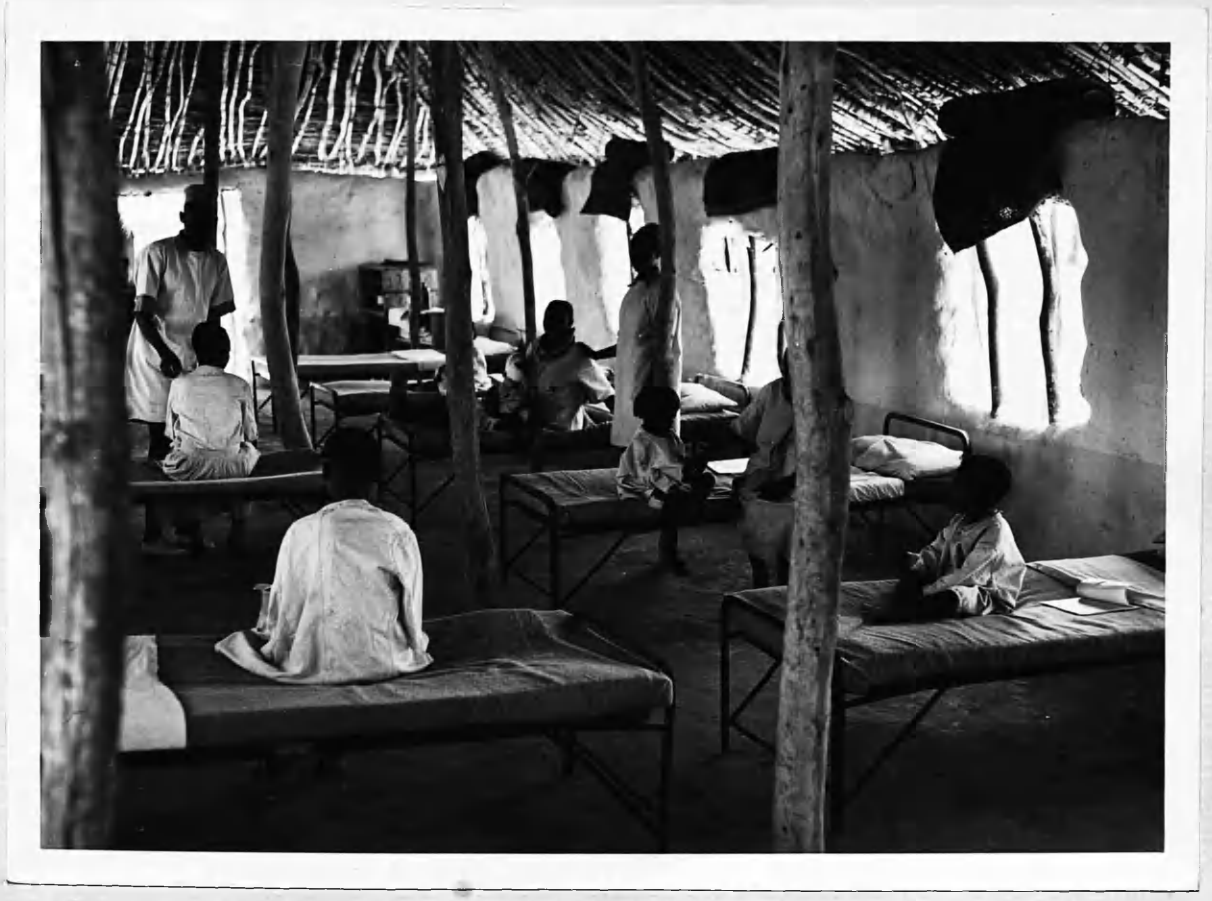
The African staff was gradually increased till in February, it consisted of the following, divided between the two places.

| | |
|---|---|
| Hospital Assistants | 4 |
| Laboratory Assistants | 1 |
| Graded Dressers | 2 |
| Ungraded Dressers | 10 |
| Driver | 1 |
| Cooks | 4 |
| Laundry man | 1 |
| Sweepers | 4 |
| Odd-Job Men | 8 |

The completion of huts in February made it possible to provide two twenty bedded wards at Tseikuru, one for males and one for females, and two five bedded

HUTS AT TSEIKURU TREATMENT CENTRE

FEMALE WARD AT TSEIKURU



PREPARING FOOD

THARAKA VILLAGE

wards at Mivukoni. Prior to this, it was difficult to find bed space for ill patients, but on completion of these wards a new policy was adopted. Patients on admission were examined and after a compulsory wash became either in-patients or out-patients. The rather more ill became in-patients who were nursed in bed. Out-patients were not put to bed, but were provided with food, a blanket and sleeping space in addition to their treatment. An out-patient who became more ill or who developed complications became an in-patient and an in-patient who improved considerably became an out-patient. Thus we saved bed space. I do not consider that it is necessary to put all cases of kala azar to bed. The disease has a slow onset like trypanosomiasis and early cases without great emaciation, oedema or complications did not require bed rest. One group of patients more or less refused to go to bed under any circumstances. They were the Watharaka, a tribe who inhabit Tharaka Location. They are not Wakamba and have nothing in common with them. Their language, appearance and customs are different and they have been in possession of their territory on both banks of the Tana River for much longer than the Wakamba have owned Kitui District. One of their customs is for the women and girls to sleep in tiny huts measuring six feet in

diameter while the men and boys sleep outside, using stones as pillows. In view of these customs, they refused to sleep in beds or in huts at all, preferring to build their own small primitive huts near the dispensary. Eventually a further large hut and staff quarters were built at Tseikuru. This brought the treatment centre up to the following:-

(a) The original dispensary used as a laboratory, treatment room, stores and staff quarters.

(b) Staff quarters consisting of seven rooms - constructed out of mud, wattle and thatch.

(c) A twenty bedded male ward and a twenty bedded female ward for in-patients.

(d) Two large 60 feet long huts for sleeping quarters for out-patients.

(e) A kitchen.

(f) Two stores in the school.

(g) Bathroom and laundry.

(h) Latrines.

(i) Living quarters for Major Penrose, and where I stayed on routine visits.

Mivukoni consisted of the following:-

(a) The original dispensary used as a treatment room and two five bedded wards and staff quarters.

(b) Two large huts used as sleeping quarters for out-patients.

(c) A kitchen.

(d) An open-air treatment room - a large opensided hut.

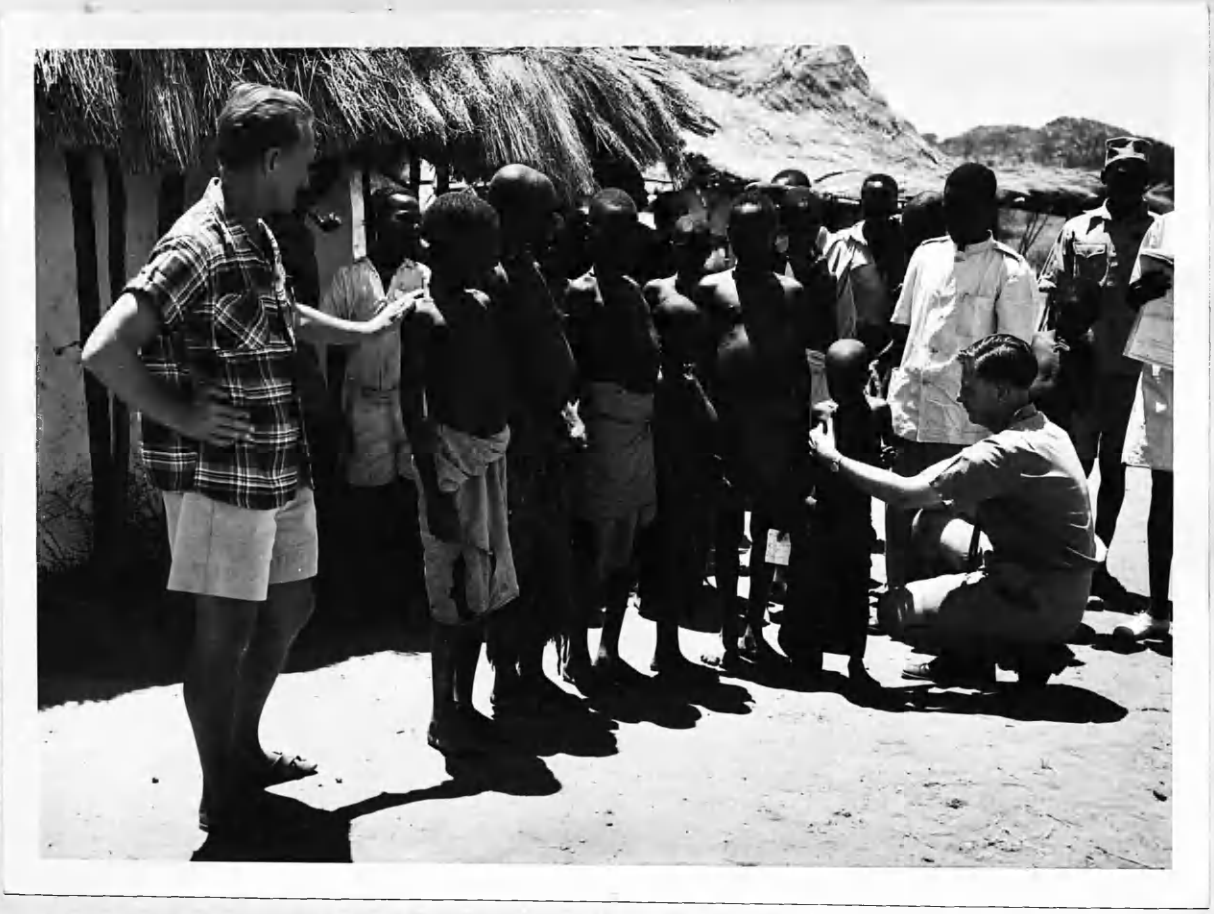
(e) Latrines.

(f) Bath place and laundry place.

With regard to latrines, it was found to be virtually impossible to get the patients to use them. In view of the fact that they went indiscriminately in the bush, it was necessary to clear the bush for a distance of 200 yards round the camps. The heat of the sun dried faeces very rapidly and whatever fly menace there was was outside the camp area and not inside!

When both treatment centres were completely established, they were run by hospital assistants under the supervision of the Assistant Hospital Superintendent and were visited by me. For the first few months, they were visited thrice monthly, then twice monthly, and finally at monthly intervals. Treatment was routine and the routine was frequently changed as I found more effective or more rapid forms of treatment - based on treating cases in the Kitui District Hospital. The hospital assistants had to use a certain amount of discretion in treating complications but the complications were invariably simple such as

PATIENTS, THE ASSISTANT HOSPITAL SUPER-
INTENDENT AND THE WRITER.



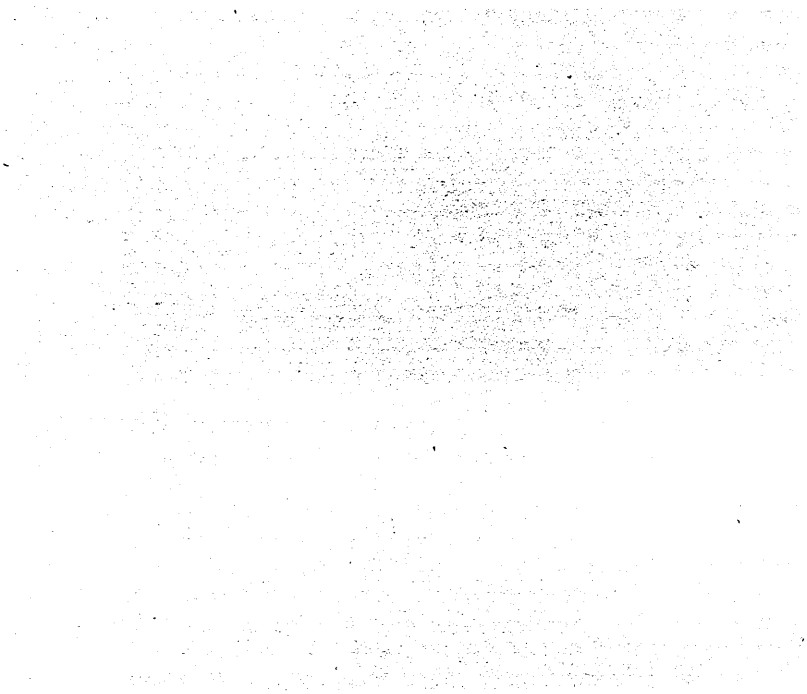
MIVUKONI TREATMENT CENTRE.

pneumonia, dysentry and various haemorrhages and it was quite within the powers of the hospital assistants to treat them. Working under the hospital assistants were the Laboratory Assistants, Graded Dressers, Dressers, Cooks and the rest. As will be seen, the system worked very well indeed, 1,830 cases of the disease being treated in the Centres in 1953 alone, and 311 at Kitui.

Such, then, were the Treatment Centres at Tseikuru and Mivukoni and both were in operation till June 1953. By that time the disease had spread in epidemic proportion to the south, through Ngomeni Location to Nuu and Endau Locations. Since there was great need of a treatment centre in Nuu Location and since, due to the adoption of a pentamedine-pentostam course, cases could be cured more rapidly, it was considered possible and advisable to move the Mivukoni staff and equipment to Nuu, where a minor treatment centre was built. Tseikuru Treatment Centre was quite adequate to deal with cases in the north of the district, in view of the adoption of the shorter course of treatment.

In mid-June 1953, treatment of cases at Nuu commenced, Mivukoni being closed down. One large hut, two kitchens and latrines were constructed there. Treatment of cases was carried on at Nuu until March 1954, when, the incidence of cases having fallen

drastically, the centre was closed down, the staff and equipment being moved to Tseikuru, which was then the only centre in operation. Finally, early in April 1954, Tseikuru received five inches of rain in one night and this did considerable damage. As a result, the entire establishment was moved to Mivukoni, which continued in operation till the writer left Kitui District in April 1955.



NUU TREATMENT CENTRE.

SIGNS AND SYMPTOMS.

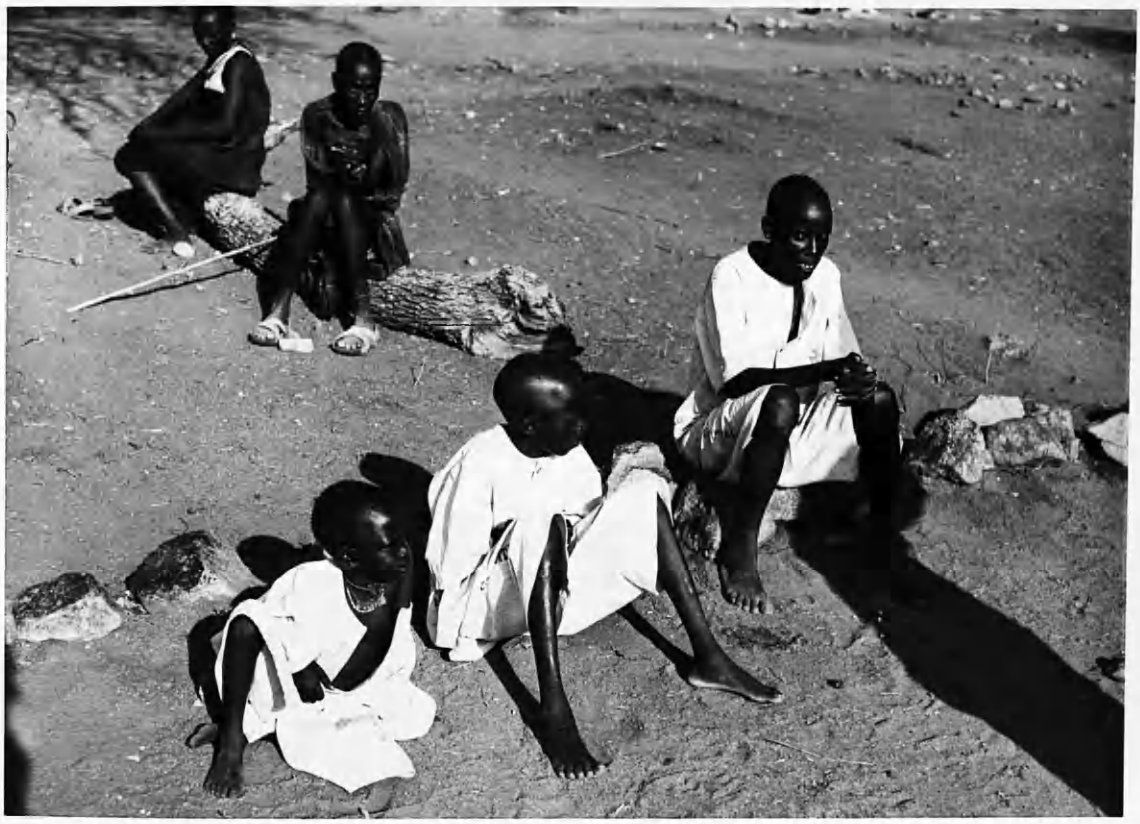
The following were observed in the cases treated:-

Incubation Period:

Prior to the occurrence of cases of kala azar in epidemic proportions there was no routine collection of sandflies in Kitui District nor was there any natural occurrence which might lead one to suppose caused the epidemic, so that it has been impossible to find out why large numbers of people suddenly appeared, suffering from kala azar. Consequently, I have no idea of the "season of infection" of the first cases. In any case, the onset of the disease is so gradual and so insidious that even if one did know the date of infection of a case, the incubation period one could infer from this knowledge would hardly be accurate, since the onset of the disease would be a variable factor, depending on the individuals previous health and what he meant by feeling unwell. What is known however is the duration of the disease before seeking treatment. The early cases complained of having been unwell for, on an average, four months duration. Subsequent to the establishment of treatment centres at Tseikuru and Mivukoni, the news got round these locations that we were curing kala azar and consequently we began to get cases of very variable durations of

disease before seeking treatment. Cases appeared who had been unwell for as little as one month and others who claimed to have been ill for as long as eight months or longer. Where these claims for lengthy duration of the disease were backed up by profound emaciation and obviously severe disease, they were believed, but there is no doubt that many people who claimed to have been ill for a year were exaggerating in order to ensure that we accepted them for treatment, not that any definite cases of the disease were ever turned away. The duration of the disease was invariably about four months in the early part of the epidemic, with a few individuals claiming to have been unwell for shorter or longer periods. Later on, as the people began to be able to recognise the symptoms and signs of the disease for themselves, the duration shortened to, on an average, two months. The other feature which altered as the epidemic and its treatment progressed, was their belief in the ability of the witch doctors to cure the disease. The early cases and most of the cases seen during the first six months had been through the hands of the witch doctors. Most cases came with septic or healing burns over the spleen due to the application of burning embers or with incisions over the liver and spleen or in lines down oedematous legs. Subsequent to the discharge from the treatment

centres of the first cured cases, the prestige of the witch doctors fell considerably and eventually we got cases direct. Both the Administration and ourselves spread propaganda about the need for early and skilled treatment but our propaganda made little headway among superstitious people till they had seen for themselves the failure of the witch doctors to cure the disease and our success. As it was, the medical attentions of the witch doctors were a profound nuisance as in the presence of leucopenia the septic burns and incisions inflicted on the patients who later came to us took a long time to heal.



CLINICAL FEATURES.

(a) SYMPTOMS.

At first, patients complained of several symptoms but eventually, as the disease became known they complained only of kala aza (the letter "r" being absent from their language)

Weakness was by far the commenest complaint. In advanced cases, it was commonly associated with giddiness.

Loss of weight was a common complaint, but not as common as weakness.

Many cases complained of enlargement of the spleen - wengu, and pain in the spleen. Since malaria is widespread, they all know where their spleens are, unlike Europeans, and know very well when they have enlargement of the organ.

Fever was not al all a common complaint, nothing like so common as the complaint of weakness, loss of weight or splenomegaly.

The above were the symptoms, combined with complaints about complications such as pneumonia and dysentry. Symptoms were always very few and very simple.

(b) SIGNS.

A very notable sign was mental apathy and depression. I do not refer to mental depression due to being ill such as one finds in other diseases. Kala azar cases are markedly depressed and apathetic, even the early cases. This was such a marked feature that frequently one could pick cases out of a crowd of Africans by looking at their faces. They sit around in a state of hopeless dejection and when questioned they take a long time to reply - frequently forgetting the question. This is in marked contrast to their usual cheerfulness and volubility in health, or even when suffering from other diseases. I consider that mental depression is a marked feature of the disease. Why it should be so I don't know, but would suggest that as Leishmania is one of the Trypanosomidae, it may produce a toxin similar to those of Trypanosoma.

Nutrition:

Nutrition naturally varied according to the duration of the disease, but in general wasteing was marked. In most cases emaciation was far in advance of the patients degree of illness and most patients were able to walk to the treatment centres - often as much as twenty miles for treatment. In most cases the ribs were prominent, with sunken interspaces and the smallness of the chest was in marked contrast to the

prominence of the abdomen. In advanced cases the limbs were so atrophied that the knee, ankle and elbow stood out as prominent swellings on stick-like limbs. The average weight of patients on admission are given below:-

MALES

| Age group in years | 0+ | 3+ | 6+ | 9+ | 12+ | 15+ | Adults |
|---|---|---|---|---|---|---|---|
| Weights in pounds | 20.5 | 30.5 | 44 | 61 | 65 | 84 | 111 |

Striking extremes of emciation in these age groups were as follows:-

| Age groups in years | 0+ | 3+ | 6+ | 9+ | 12+ | 15+ | Adults |
|---|---|---|---|---|---|---|---|
| Weights in pounds | - | 21-44 | 29-67 | 42-83 | 50-90 | 53-111 | 66-146 |

FEMALES

| Age groups in years | 0+ | 3+ | 6+ | 9+ | 12+ | 15+ | Adults |
|---|---|---|---|---|---|---|---|
| Weights in pounds | 20 | 35 | 42 | 63 | 59 | 78 | 94 |

Striking extremes of emaciation in these groups were:-

| Age groups in years | 0+ | 3+ | 6+ | 9+ | 12+ | 15+ | Adults |
|---|---|---|---|---|---|---|---|
| Weights in pounds | - | 28-40 | 33-63 | 44-82 | 51-80 | 75-87 | 76-129 |

The photographs of cases illustrate typical cases and with such cases one could commonly demonstrate both myokymia and myotatic irritability.

Hair Changes:

These were not marked nor common except in young children under the age of six years and in all advanced cases. Changes resembled those of kwashiorkor. First changes were thinning of the hair and a loss of its natural "kinkiness" and these were followed by the hair acquiring a slightly reddish tint. These changes responded only very slowly to treatment. The spleen would disappear completely, the fever cease and the patient gain in weight before there was any improvement in the hair condition.

Pigmentation:

This was not at all common but occurred usually in the same patients as exhibited hair changes, that is, young children and advanced cases. Again it resembled the skin changes of kwashiorkor and usually took the form of dark glazed patches on the extensor aspects of the limbs - commonly the fronts of the legs, where the skin had a thin atrophic appearance. Although I have no figures to prove it, I got the impression that skin changes cleared up more rapidly than the hair changes.

Oedema:

Oedema was not commonly massive. Out of five hundred cases chosen at random, seventy six are recorded as having oedema and of these eight had a

considerable amount of oedema. I was particularly interested in correlating the occurrence of oedema with the results of the aldehyde test, so cases were particularly carefully examined in this respect. In most cases of kala azar, firm digital pressure revealed slight palpable oedema but no visual oedema. In about a sixth of the cases, visual oedema occurred - the pitting ceasing halfway between the knee and the ankle and in a very few (8 in 500) pitting extended up to the knee and was demonstrable in the hands. In several cases, massive oedema of the scrotum and vulva were seen. Abdominal ascites was not seen.

Lymph Glands:

Since minor wounds of the feet and legs and leg ulcers are common in Africa, it is common to find some degree of enlargement of the inguinal lymph glands in people who are not suffering from kala azar, but enlargement of the cervical, axillary and epitrochlear glands is not common in healthy people. In all cases of kala azar, there was some degree of enlargement of one or all of these groups. These groups were not always equally enlarged, the axillary glands might be large and easy to feel while the cervical glands and epitrochlears were small or vice versa, but in all cases there was evidence of an abnormal glandular enlargement somewhere. The axillary

glands were very commonly enlarged and easy to feel. They varied considerably in size from small hard glands the size of a raisin to large softer glands the size of a broad bean. They were always mobile and non-tender. In no case did suppuration occur. Glandular enlargement was so invariable even in very early cases that I regarded it was a sine qua non in the diagnosis of kala azar.

Respiratory System:

There were no specific signs. Chronic bronchitis due to malaria and dust are common and consequently one frequently heard rhonchi and rales on chest examination, but I did not regard them as being due to kala azar but due to other disease. Broncho-pneumonia or consolidation of a lobule due to infection superimposed upon weakness due to kala azar were occasionally seen especially in children.

Cardiovascular System:

No specific heart changes were seen, but tachy-cardia due to secondary anaemia was common.

Gastro-Intestinal System:

Furring of the tongue was invariable, but was due most likely to the almost invariable constipation from which Africans suffer.

The size of the abdomen varied with the degree of splenomegaly. In early cases where the spleen

was two or three fingers enlarged, there was no protuberance of the abdomen, but in late cases where the lower pole of the spleen was well into the right iliac fossa, the abdomen was enormous, in marked contrast to the wasteing of the rest of the body. Abdominal ascites was not seen.

Splenomegaly:

The spleen was enlarged in all cases and was frequently tender. In view of the fact that very large numbers of cases had to be dealt with by a limited staff, the size of the spleen was recorded in finger breadths from the costal margin towards the umbilicus. It was noted that these enormous spleens appeared to move about quite a lot and a spleen which was observed on one day to be lying over to the right of the midline of the abdomen with its tip five finger-breadths from the costal margin might well be found two days later to be entirely on the left side of the abdomen towards the left iliac fossa with its tip six or seven finger-breadths from the costal margin. Since one finds that if one keeps a doubtful case without treating him that the spleen enlarges, one might expect that a patient who had been ill for eight months on admission would have a larger spleen than one who had been ill for only two months. However, this was not so. There appears to be no

correlation between the duration of the illness on admission and the size of the spleen.

The degree of enlargement of spleens, in finger-breadths, without taking into account duration of the illness, were as follows, the figures representing the number of patients:-

| Age Group | FINGER-BREADTHS OF SPLENIC ENLARGEMENT | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Totals |
| 0+ | - | 1 | 2 | 4 | 1 | - | - | - | - | 8 |
| 3+ | - | - | 6 | 16 | 13 | 1 | 2 | 1 | - | 39 |
| 6+ | 1 | 5 | 11 | 16 | 34 | 13 | 8 | 2 | 2 | 92 |
| 9+ | - | 2 | - | 7 | 20 | 14 | 1 | 3 | - | 47 |
| 12+ | - | 2 | 6 | 8 | 8 | 16 | 9 | 8 | 1 | 58 |
| 15+ | - | 3 | 3 | 1 | 6 | 12 | 2 | 5 | 1 | 33 |
| Adults | - | 5 | 19 | 33 | 31 | 89 | 19 | 24 | 3 | 223 |
| TOTAL | 1 | 18 | 47 | 85 | 113 | 145 | 41 | 43 | 7 | 500 |

From this table 39% of adult spleens were six finger-breadths enlarged. 68.6% were in the group 4, 5 and 6 finger-breadths, 20.6% were larger and 10.8% were smaller than this group. There was no difference between the sexes in the size of the spleen on admission.

Hepatomegaly:

Out of the five hundred cases under review, 331 i.e. 66.2% had some degree of liver enlargement. The liver was firm, smooth and slightly tender. Average sizes of liver enlargement for the various age groups

and the number in each age group showing enlargement were as follows:-

| | AGE GROUPS OF PATIENTS IN YEARS | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0+ | 3+ | 6+ | 9+ | 12+ | 15+ | Adults |
| Average size of liver in finger breadths | 1.5 | 1.4 | 1.8 | 2 | 2.1 | 1.6 | 2 |
| No. of patients | 2 | 20 | 64 | 35 | 44 | 17 | 149 |

There was no sex difference in the degree of enlargement and no variation according to the duration of the illness on admission. Abdominal ascites, caput medusae or other signs of engorgement of the portal system were not seen.

Genitourinary System:

There were no specific signs. Urine examination was negative or pus cells and a little albumen demonstrated - these latter due to chronic gonorrhoea.

Nervous System:

No abnormalities were detected apart from mental depression already discussed.

LABORATORY INVESTIGATIONS:

While attempts were made to get investigations carried out on all cases, we were hampered by two factors, namely shortage of laboratory assistants and the rate at which cases presented themselves for treatment. There was one laboratory assistant at the Kitui Hospital, who did an enormous amount of work and did it well, but the laboratory assistants employed at Tseikuru were not satisfactory. The first one was arrested and imprisoned for crime within several months of starting work at Tseikuru. His successor worked satisfactorily, but was deported for taking the Mau Mau oath. Thereafter we had no laboratory assistants in the kala azar area, as they appeared to be not worth their nuisance value and in any case it was easy to recognize cases of kala azar. With regard to the other factor, rapid influx of patients, it is sufficient to point out that in April 1953 there were 312 admissions. Despite all this, a fair amount of laboratory work was done. The following are based on five hundred cases chosen at random from patients treated at Kitui District Hospital and the Treatmant Centres.

Blood Picture.

(a) Haemoglobin Values.

All haemoglobins were estimated with a Sahli

haemoglobinometer. Of 361 haemoglobins estimated the average was 56.7%. There was no significant difference in values between age groups. The distribution of levels about the average are given in the table below:-

| Haemoglobin Percentage | Male Cases | Female Cases |
|---|---|---|
| 0+ | 0 | 0 |
| 10+ | 1 | 0 |
| 20+ | 6 | 2 |
| 30+ | 22 | 7 |
| 40+ | 49 | 22 |
| 50+ | 83 | 41 |
| 60+ | 60 | 19 |
| 70+ | 25 | 5 |
| 80+ | 9 | 1 |
| 90+ | 8 | 0 |
| 100 | 1 | 0 |
| TOTALS | 264 | 97 |

72.7% of males had haemoglobin levels between 40% and 69% and 84.5% of females were in this range.

In 66 cases in the series with positive spleen punctures, the range of haemoglobin levels was as follows:-

| Haemoglobin Percentage | Number of cases |
|---|---|
| 30+ | 4 |
| 40+ | 14 |
| 50+ | 15 |
| 60+ | 19 |
| 70+ | 10 |
| 80+ | 2 |
| 90+ | 2 |
| | 66 |

72.7% lie in the range 40% to 69%. Extremes in this group were 30% and 96%. This latter patient

(with 96% haemoglobin) was an adult male who had been unwell for three months before coming for treatment. On admission his weight was 53lbs, his spleen six finger-breadths enlarged and his liver three finger-breadths. Aldehyde test was positive in five minutes. His white blood count was 5,100 with 17% neutrophils. Eosinophils were absent. Spleen puncture was positive. He was under treatment for 69 days and was treated with ten injections of ureastibamine 0.05 gm I.V. - 0.25 gm.I.V. and two 2G courses of pentamidine. The interesting thing was that his haemoglobin dropped after admission and was only 50% halfway through treatment i.e. a level which one would expect in view of his clinical condition. This occurred despite administration of ferrous sulphate. On discharge, his haemoglobin was 75% and his spleen one finger-breadth enlarged.

The case with the 30% haemoglobin was a male, fifty years of age, who had been ill for two months. On admission, his weight was 109lbs, his spleen six and his liver one finger-breadth enlarged. His red blood count was 1,900,000, his white blood count 1,700 with 40% neutrophils and absent eosinophils. Aldehyde test was positive (twenty minutes) and his spleen puncture positive. He was treated with fifteen injections of urea stibamine (0.05- 0.25 G I.V) and

a 2 gm. course of pentamidine. Duration of treatment was 78 days and on discharge his spleen was no longer palpable and his haemoglobin 60%

Red Blood Counts.

Haemoglobin estimations were done rather than red blood counts but 107 were recorded. The average figure was 2,700,000/cmm with a distribution as follows:-

| Count in Millions | No. of cases | No. of cases with Positive Spleen Puncture |
|---|---|---|
| 0.5+ | 2 | 0 |
| 1.0+ | 0 | 0 |
| 1.5+ | 10 | 5 |
| 2.0+ | 29 | 13 |
| 2.5+ | 28 | 10 |
| 3.0+ | 24 | 6 |
| 3.5+ | 8 | 3 |
| 4.0+ | 5 | 1 |
| 4.5+ | 1 | 0 |
| TOTAL | 107 | 38 |
| Average: | 2,700,000 | 2,600,000 |

Anisocytosis, poikilocytosis and ring-staining were commonly seen.

Leucocyte Counts.

In the series, 349 were recorded, the average being 3,900/cmm. The distribution was as follows:-

| Count in thousands. | Number of cases. |
|---|---|
| 1+ | 5 |
| 1.5+ | 24 |
| 2+ | 54 |
| 2.5+ | 55 |
| 3+ | 44 |
| 3.5+ | 30 |
| 4+ | 39 |
| 4.5+ | 19 |

| | |
|---|---|
| 5+ | 19 |
| 5.5+ | 9 |
| 6+ | 11 |
| 6.5+ | 12 |
| 7+ | 28 |
| TOTAL | 349 |

8.3% of the cases had a white blood count less than 2,000 and 60.8% were less than 4,000/cmm.

In 66 cases with positive spleen punctures, whose counts were recorded, the average figure was 3,100 with a distribution as follows:-

| Count in thousands. | Number of cases. |
|---|---|
| 1+ | 3 |
| 1.5+ | 9 |
| 2+ | 13 |
| 2.5+ | 11 |
| 3+ | 8 |
| 3.5+ | 5 |
| 4+ | 8 |
| 4.5+ | 1 |
| 5+ | 5 |
| 5.5+ | 0 |
| 6+ | 0 |
| 7+ | 0 |
| TOTAL | 66 |

In this group 18.1% had a count less than 2000 and 74.2% were less than 4000/cmm.

Differential Leucocyte Counts.

In the total series, 315 differential counts were recorded. The granular leucocytes were invariably depressed and the lymphocytes raised. Monocytes were at their usual level - a monocytosis was never seen. The average figure for neutrophil polymorphs in the series was 32.5% with a distribution as follows:-

| Percentage of Neutrophil Polymorphs | Number of Cases | Number of cases with Positive Spleen Punctures |
|---|---|---|
| 10+ | 5 | 0 |
| 15+ | 27 | 3 |
| 20+ | 51 | 13 |
| 25+ | 56 | 11 |
| 30+ | 47 | 10 |
| 35+ | 48 | 11 |
| 40+ | 29 | 8 |
| 45+ | 29 | 7 |
| 50+ | 17 | 2 |
| 60+ | 5 | 0 |
| 70+ | 1 | 0 |
| TOTALS | 315 | 65 |
| Average percentage of Polymorphs | 32.5 | 32.9 |

In only 7.3% of the total number of 315 cases were the neutrophils above 50%.

It is notable that in the 349 total leucocyte counts recorded 51 were more than 6,000 including 28 more than 7,000, that is, apparently normal, but the differential counts were abnormal, the average figure for neutrophil leucocytes being only 35.4%. The following are examples:-

(1) A male child of fifteen months of age was admitted suffering from kala azar with broncho-pneumonia. His total leucocytes were 15,200 per cubic millimetre but only 32% of them were neutrophils. The high polymorph count was obviously due to bronchopneumonia.

(2) In another case with a high blood count of 6,200 and a positive spleen puncture, the differential

neutrophil count was 37% and the apparent normality of the total leucocyte count was due to amoebiasis in addition to kala azar.

Eosinophils were absent in 233 cases out of the total of 315, that is, in 73.9% of the cases. Distribution was as follows:-

| Percentage of Eosinophils | Number of cases |
|---|---|
| 0 | 233 |
| 1% | 42 |
| 2% | 23 |
| 3% | 8 |
| 4% | 3 |
| More than 4% | 6 |
| | 315 |

Similar figures occurred in cases with positive spleen punctures:-

| Percentage of Eosinophils | Number of cases |
|---|---|
| 0 | 51 |
| 1% | 9 |
| 2% | 2 |
| 3% | 3 |
| | 65 |

To sum up, the leucocyte count was below 4000 in 60.8% of the cases and the average neutrophil count was 32.5%. In only 7.3% of the cases was the neutrophil count above 50%. Where the total leucocyte count was above 6000, the average neutrophil count was 35.4% and there was secondary infection. Depression of the leucocytes and neutrophils was so

invariable that it was a sine qua non of diagnosis. An apparently normal or raised leucocyte count was always associated with a low neutrophil count and was an indication of secondary infection or other disease.

Aldehyde Test:

Aldehyde tests were performed on all patients except young children, from whom it was difficult to obtain venous blood. In the absence of a laboratory assistant at the treatment centres, these tests were carried out by the hospital assistants, who were easily trained to do them. The criterion of a positive test was that the solidified serum resembled boiled white of agg and the test-tube could be inverted without the serum running out. At first, sera were examined only after twenty minutes and the results recorded as positive or negative, but soon the number of minutes in which the test became positive was recorded. Consequently in the following table, since forty four of the seventy six recorded as being positive in twenty minutes were examined only after twenty minutes, they may have been positive in a shorter period:-

| | |
|---|---|
| Total aldehyde tests performed | 437 |
| Total positive in 1 minute | 23 |
| " " " 2 " | 130 |
| " " " 3 " | 2 |
| " " " 5 " | 46 |
| " " " 10 " | 24 |

| | |
|---|---|
| Total positive in 15 minutes | 3 |
| " " " 20 " | 76 |
| | 304 |

Percentage positive 69.6%

As a matter of interest, sera which had not solidified at twenty minutes were allowed to run on and of the present series a further fifty one solidified after longer periods - as follows:-

| | |
|---|---|
| 25 minutes | 14 |
| 30 " | 26 |
| 45 " | 7 |
| 60 " | 4 |
| Total | 51 |

Aldehyde tests in cases with positive spleen punctures gave similar results:-

| | |
|---|---|
| Total aldehyde tests performed | 85 |
| Positive in 1 minute | 6 |
| " " 2 " | 28 |
| " " 5 " | 8 |
| " " 10 " | 3 |
| " " 15 " | 1 |
| " " 20 " | 20 |
| Total positive | 66 |
| Percentage positive | 77.6% |

Allowing the test to run on gave the following results:-

| | |
|---|---|
| 25 minutes | 4 |
| 30 " | 1 |
| 45 " | 3 |
| Total | 8 |

No solidification whatsoever 11.

Although in performing Napier's Test, it is

specified that the serum - 30% formalen mixture should be read after twenty minutes, I would suggest that an interval of thirty minutes would be better as it raises the percentage of positive tests to about 80%. With the present series and on the basis of a twenty minute interval only about 70% were positive.

Spleen Puncture:

Spleen punctures were done at the beginning of the epidemic and on special series to estimate the value of various forms of treatment and later, from time to time, to check on the exactness of clinical diagnosis of the disease. Of the present series, one hundred and four were spleen punctured. Eighty five were positive and nineteen negative.

COURSE OF THE DISEASE.

An analysis of the temperatures of the five hundred cases representative of the epidemic is given in the following table:-

| Temperatures reached | Number of cases | Percentage of cases |
|---|---|---|
| Completely afebrile | 145 | 29 |
| 100° maximum | 95 | 19 |
| 101° maximum | 67 | 13.4 |
| 102° maximum | 84 | 16.8 |
| 103° maximum | 66 | 13.2 |
| 104° maximum | 27 | 5.4 |
| 105° maximum | 16 | 3.2 |
| | 500 | 100.0 |

It is noteworthy that 29% of the cases were afebrile throughout and that in a further 19% of cases the temperature did not exceed 100°. It is not known whether a double daily rise# occurred. The great majority of cases were on twelve-hourly temperatures, the more ill being on six-hourly. A double daily rise was not observed in the latter.

All sorts of fevers were observed, but in general, cases with high fever tended to have remittent or intermittent fevers rather than sustained fevers. When the latter settled they did so gradually over several days.

The duration of fever depended on the treatment adopted and obviously on the occurrence or otherwise of febrile complications. The average duration of fever in forty uncomplicated cases treated with urea

stibamine alone was 18.5 days. When pentamidine and urea stibamine were employed, the average duration of fever in 73 uncomplicated cases was 15.9 days. When pentamidine followed by pentostam was employed, the average duration in 74 uncomplicated cases was 11.7 days. It is noteworthy that the pentamidine - pentostam course terminated fever a week earlier than urea stibamine alone. These figures give the number of days to eliminate fever completely and the fact that there is a difference depends on the use of pentamidine principly and to a lesser extent on the use of pentostam which appears to be a far more effective antimonial than urea stibamine. Pentamidine will considerably lower a high remittent fever within five days. The figures above, it should be stressed, indicate the number of days before complete cessation of fever.

COMPLICATIONS.

In the present series, the following complications occurred:-

(A) GASTROINTESTINAL SYSTEM.

Enteritis or Gastroenteritis:

These were by far the commonest complication, fifty six males and twelve females suffering from them. Severity varied very considerably from an infrequent diarrhoea - four or five loose stools daily - to a frequent diarrhoea, with frequent vomiting, which proved fatal despite sulphonamide therapy and transfusion. Vomiting was commoner in children than in adults and in general, they were much more ill. Gastroenteritis occurred frequently in the course of measles and bronchopneumonia.

Stool examination usually revealed pus cells and a few macrophages, red blood cells being absent.

Treatment was with sulphaguanidine, 6 G. as an initial dose, followed by 3 G. four hourly for an adult and, where necessary, transfusion. In severe cases, it was necessary to employ Tincture of Opium.

Enteritis and gastroenteritis were common predisposing causes of death ten males and four females dying of this complication.

Bacillary Dysentry.

Five males and one female suffered from this.

It tended to be severe and was treated along similar lines to gastroenteritis.

Amoebic Dysentry.

Four males were found to be suffering from amoebic dysentry, while under treatment for kala azar. Unless the dysentry were severe, with frequent stools and considerable blood loss, the policy was to complete the course of treatment which the patient was on at the time - urea stibamine, pentamidine or pentostam, and then give a short course of emetine, say one grain daily for six days, before resuming the kala azar treatment. Finally, these patients were given a twelve day course of emetine-bismuth-iodide. The treatment of amoebic dysentry occurring in the course of kala azar was not a problem, as was the treatment of gastroenteritis, which occasionally progressed, unaffected by any treatment.

Mouth Complications.

Eight males and four females suffered from ulceration in the mouth. Ulcers were, in these cases, small and resembled those of Vincent's Angina. Antiseptic mouth washes effected cure. None of the five hundred cases in this series had cancrum oris, but this was not an infrequent complication in the epidemic and all stages were seen. Cases who developed cancrum oris at first complained of soreness of the

mouth. On examination at this stage, all that could be seen was some swelling of the cheek and inflammation of the buccal mucosa. Within forty eight hours the area involved was sloughing and resembled wet chopped hay. At this stage, the complication was invariably beyond cure, but in the early stages massive doses of procaine penicillin (1.2 $\mu$ U) daily appeared to arrest progress of the complication. In one case, the ramus of the mandible was completely laid bare, from the angle to within an inch of the symphysis mentis.

Oozing haemorrhages from the gums occurred in two cases in the series. These did not resemble onyalai, but were more like scurvy. Treatment was by intramuscular injection of acetomenaphthone 5 mgms thrice daily supplemented by ascorbic acid in case haemorrhage was due to scurvy rather than liver dysfunction.

One male suffered from a dental abscess and two suffered from tonsillitis. One adolescent male developed a faecal fistula in an area of his abdomen burned by the witch doctor before admission for treatment.

(B) RESPIRATORY SYSTEM:

Chest complications were common. In the series seven males suffered from acute bronchitis and sixteen

males and four females from bronchopneumonia. Consolidation of an entire lobe, or most of a lobe, was commoner, twenty seven males and six females suffering from lobar pneumonia. Treatment was by procaine penicillin and sulphathiazole.

Despite emphasis in the textbooks on the occurrence of pulmonary tuberculosis as a complication of kala azar, it occurred only once in the series and in the entire outbreak was by no means common.

(C) EYE:

Two females suffered from conjunctivitis and a male developed a corneal ulcer. A third female had massive subconjunctival haemorrhage, which responded to large doses of acetomenaphthone.

(D) EAR:

A male and a female suffered from acute otitis media and two males developed acute mastoiditis.

Six males and two females suffered from epistaxis. This complication was sometimes severe, cases requiring frequent repacking of their nares in addition to acetomenaphthone.

GENITO-URINARY SYSTEM.

One male and one female suffered from haematuria.

Since there were no other symptons or signs to suggest nephritis, and since schistosomiasis is common in the district, but not in the kala azar area, their urines were examined frequently for ova of schistosoma haematobium, but no ova were seen. It was impossible to cystoscope these cases. Since haemorrhage ceased under treatment with acetomenaphthone, it is perhaps reasonable to assign these haematurias to liver dysfunction and lack of vitamin K.

VARIOUS:

Unfortunately, in view of overcrowding in the Kitui District Hospital and in the Treatment Centres and in view of the difficulty of segregating infectious cases due to lack of quarters and indiscipline of the patients, hospital cross-infection occurred. Three males and two females suffered from chicken pox, and three males and one female suffered from pertussis, and one male from mumps. These infections were not particularly serious, but unfortunately measles also occurred. Measles tends always to be serious in Africans, but when it occurs with kala azar, it is very serious. Twelve males and seven females suffered from measles and in seven of the former and four of the latter the disease progressed to bronchopneumonia. Patients with kala azar, measles and bronchopneumonia rapidly became comatose and four males and two females

with these complications died.

Four males had malaria, not particularly serious.

Sepsis was not common, one female suffering from cellulitis of foot and two from boils. Two males and one female suffered from ulcers of their legs.

Two patients suffered from avitaminosis. One exhibited marked phrynoderma and the other suffered from pellagra and ariboflavinosis. It is difficult to distinguish between diarrhoea and pigmentation of kala azar and the diarrhoea and pigmentation of pellagra but I think it likely that the patient had pellagra as the distribution was typical and there was distinct evidence of ariboflavinosis - marked dyssebacia on the nose and angular ulcers at the mucocutaneous junctions of the nose, eye, mouth and penis. One male and one female had slight jaundice on admission. This must have been due to haemolysis, since both did well under treatment with pentamidine and urea stibamine.

One case, who had had a two gramme course of pentamidine and four injections (0.05 G, 0.10 G, 0.15G, 0.20 G) of urea stibamine on alternate days, developed severe intractable vomiting and died, presumably due to idiosyncracy to urea stibamine. Another fatality occurred possibly due to urea stibamine, thirteen injections having been given.

A third case died in hypoglycaemic coma, due to pentamidine.

INCIDENCE OF THE DISEASE.

The sparse distribution of the population over the district has already been discussed. Although over three thousand cases were treated within twenty eight months and although as many as three hundred and twelve new cases presented themselves for treatment in the month of April 1953, the incidence of the disease was never locally very high. Whole villages - and villages consisted of, at the most, two families - were never infected. Rather, one found two or three infected persons at each village. Certain villages were notorious for continually producing cases, while others produced very few or none at all.

From a low figure of seven admissions in September 1952, twenty one in October and fifty two in November 1952, admissions rose rapidly to a peak figure of three hundred and twelve in April 1953. Thereafter they fell again to forty four in November 1953, making a symmetrical graph.

In 1954, until August, admissions were pretty steady around seventy per month, thereafter dropping to from twenty to thirty cases monthly.

The actual figures of admissions of cases from Kitui District, exclusive of cases from Meru District,

are given in the following table:-

| Year | Month | Males | Females | Monthly Total | Yearly Total |
|---|---|---|---|---|---|
| 1952 | September | 6 | 1 | 7 | |
| | October | 14 | - | 14 | |
| | November | 26 | 5 | 31 | |
| | December | 60 | 37 | 97 | |
| | TOTALS | 106 | 43 | 149 | 149 |
| 1953 | January | 117 | 37 | 154 | |
| | February | 116 | 39 | 155 | |
| | March | 183 | 64 | 247 | |
| | April | 188 | 124 | 312 | |
| | May | 148 | 80 | 228 | |
| | June | 188 | 98 | 286 | |
| | July | 126 | 69 | 195 | |
| | August | 69 | 39 | 108 | |
| | September | 72 | 33 | 105 | |
| | October | 80 | 35 | 115 | |
| | November | 31 | 14 | 45 | |
| | December | 35 | 9 | 44 | |
| | TOTALS | 1353 | 641 | 1994 | 1994 |
| 1954 | January | 58 | 19 | 77 | |
| | February | 59 | 15 | 74 | |
| | March | 46 | 30 | 76 | |
| | April | 38 | 27 | 65 | |
| | May | 54 | 20 | 74 | |
| | June | 35 | 8 | 43 | |
| | July | 35 | 20 | 55 | |
| | August | 47 | 30 | 77 | |
| | September | 29 | 22 | 51 | |
| | October | 24 | 10 | 34 | |
| | November | 28 | 8 | 36 | |
| | December | 12 | 8 | 20 | |
| | TOTALS | 465 | 217 | 682 | 682 |

| | |
|---|---|
| TOTAL MALES | 1924 |
| TOTAL FEMALES | 901 |
| TOTAL CASES | 2825 |

It has already been pointed out that the northern locations, where the disease first occurred in epidemic proportions, are separated from Meru District

by the Tana River. The part of Meru alongside the river is inhabited by a tribe called the Watharaka, the same tribe as inhabit the Tharaka Location in the north of Kitui District, to the west of Tseikuru Location. These people, a riverine tribe, are distinct from the Wameru, who inhabit the major part of Meru District. Although the medical care of the Watharaka of Meru was theoretically the responsibility of the Medical Officer of Health, Meru, their nearness to the river made them come for treatment to Tseikuru Treatment Centre, which was only eighteen miles south of the river. Tseikuru enjoyed a fair amount of fame and several cases walked for as much as five hours on the Meru side of the river in order to cross to the Kitui side, in all, a distance of perhaps forty miles. Three cases had to be treated for crocodile bites, having been attacked while crossing the river. Below is a table of cases treated from Meru District.

| Year | Month | Males | Females | Monthly Total | Yearly Total |
|---|---|---|---|---|---|
| 1952 | November | 1 | - | 1 | |
| | December | 1 | - | 1 | 2 |
| 1953 | January | 1 | - | 1 | |
| | February | 4 | - | 4 | |
| | March | 2 | - | 2 | |
| | April | - | - | - | |
| | May | 10 | 3 | 13 | |
| | June | 25 | 13 | 38 | |
| | July | 21 | 4 | 25 | |
| | August | 14 | 3 | 17 | |
| | September | 16 | 5 | 21 | |
| | October | 7 | 3 | 10 | |
| | November | 2 | 1 | 3 | |
| | December | 8 | 2 | 10 | 147 |

| Year | Month | Males | Females | Monthly Total | Yearly Total |
|---|---|---|---|---|---|
| 1954 | January | 10 | 1 | 11 | |
| | February | 14 | 3 | 17 | |
| | March | 16 | 10 | 26 | |
| | April | 13 | 2 | 15 | |
| | May | 11 | 2 | 13 | |
| | June | 1 | - | 1 | |
| | July | 3 | 2 | 5 | |
| | August | 3 | - | 3 | |
| | September | 1 | 1 | 2 | |
| | October | - | 3 | 3 | |
| | November | - | - | - | |
| | December | 1 | - | 1 | 97 |

| | |
|---|---|
| TOTAL MALES | 188 |
| TOTAL FEMALES | 58 |
| TOTAL CASES | 246 |

The total cases treated from September 1952 till December 1954 were thus as follows:-

| | |
|---|---|
| Total males from Kitui District | 1924 |
| Total males from Meru District | 188 |
| | 2112 |
| Total females from Kitui District | 901 |
| Total females from Meru District | 58 |
| | 959 |

| | |
|---|---|
| TOTAL MALES TREATED | 2112 |
| TOTAL FEMALES TREATED | 959 |
| TOTAL CASES TREATED | 3071 |

Age Distribution of Cases.

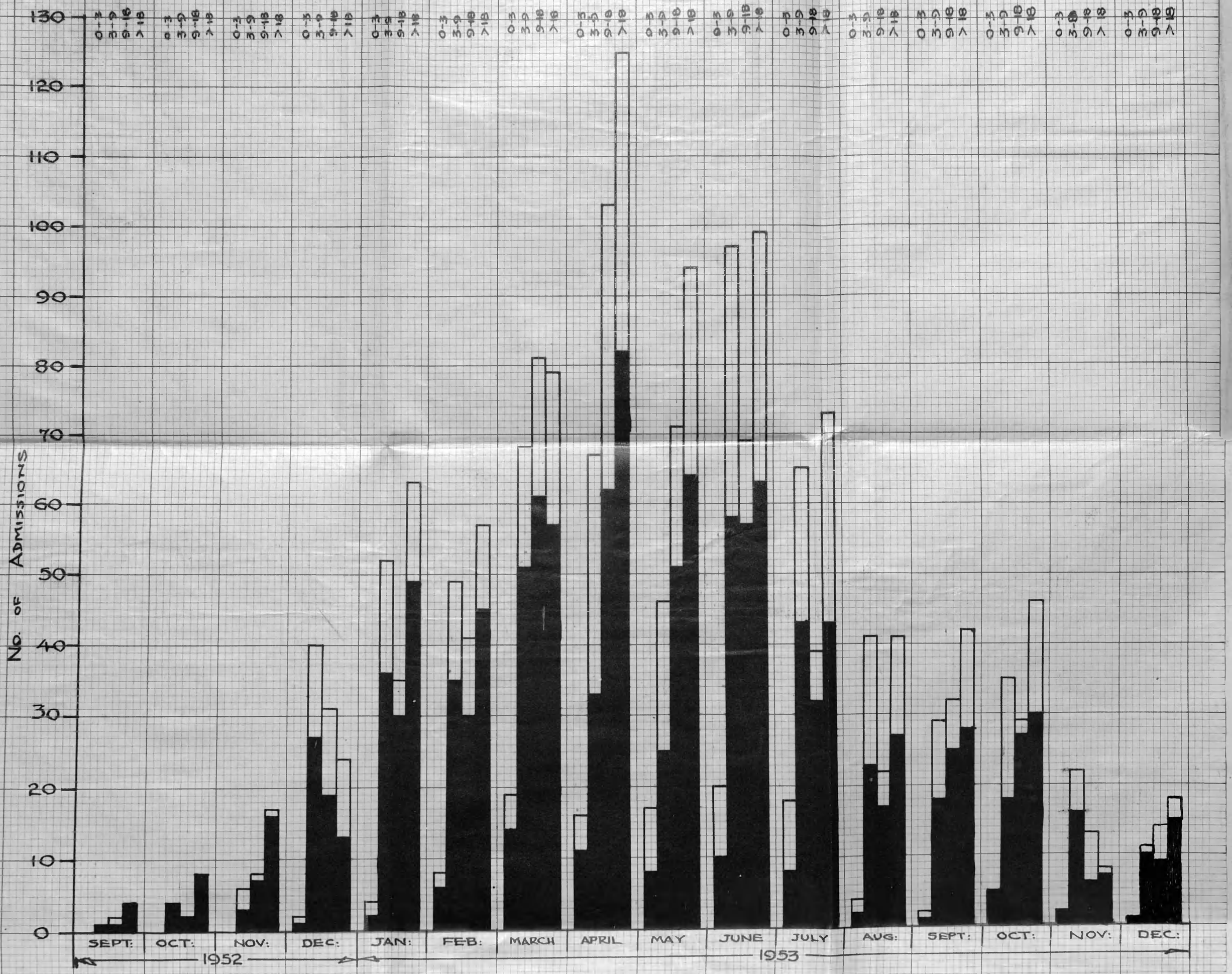
Attached is a graph showing the incidence of cases admitted from Kitui District in the last four months of 1952 and in 1953. Age and sex distribution are shown in the graph.

A summary of the age distribution is given in the table below:-

# KALA-AZAR ~ KITUI DISTRICT

## INCIDENCE BY SEX AND AGE GROUPS

2 dips each




TOTAL CASES TO DATE-

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M | 6 | 20 | 46 | 106 | 223 | 339 | 522 | 710 | 858 | 1046 | 1172 | 1241 | 1313 | 1393 | 1424 | 1459 |
| F | 1 | 1 | 6 | 43 | 80 | 119 | 183 | 307 | 387 | 485 | 554 | 593 | 626 | 661 | 675 | 684 |
| T. | 7 | 21 | 52 | 149 | 303 | 458 | 705 | 1017 | 1245 | 1531 | 1726 | 1834 | 1939 | 2054 | 2099 | 2143 |

| Year | MALE CASES Age groups in years | | | | Total | FEMALE CASES Age groups in years | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0-3 | 3+ | 9+ | 18+ | | 0-3 | 3+ | 9+ | 18+ | |
| 1952 | 1 | 35 | 29 | 41 | 106 | 1 | 16 | 14 | 12 | 43 |
| 1953 | 70 | 368 | 406 | 509 | 1353 | 46 | 216 | 144 | 235 | 641 |
| 1954 | 23 | 129 | 160 | 153 | 465 | 8 | 80 | 41 | 88 | 217 |
| TOTALS | 94 | 532 | 595 | 703 | 1924 | 55 | 312 | 199 | 335 | 901 |

The percentage of male and of female cases in the various age groups are as follows:-

Male Cases.

| Age groups in years | Percentage of Male Cases |
|---|---|
| 0-3 | 4.9 |
| 3+ | 27.6 |
| 9+ | 30.9 |
| 18+ | 36.9 |

Female Cases.

| Age groups in years | Percentage of Female Cases |
|---|---|
| 0-3 | 6.1 |
| 3+ | 34.6 |
| 9+ | 22.1 |
| 18+ | 37.2 |

The age distribution of cases from Meru District is given in the table below:-

| Year | MALE CASES Age groups in years | | | | Total | FEMALE CASES Age groups in years | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0.3 | 3+ | 9+ | 18+ | | 0-3 | 3+ | 9+ | 18+ | |
| 1952 | - | - | - | 2 | 2 | - | - | - | - | 0 |
| 1953 | 6 | 31 | 34 | 42 | 113 | 2 | 7 | 11 | 14 | 34 |
| 1954 | 5 | 18 | 27 | 23 | 73 | 1 | 10 | 8 | 5 | 24 |
| TOTALS | 11 | 49 | 61 | 67 | 188 | 3 | 17 | 19 | 19 | 58 |

The percentage of the male and female cases in the various age groups are as follows:-

Male Cases.

| Age groups in years | Percentage of Male Cases |
|---|---|
| 0-3 | 5.8 |
| 3+ | 26.1 |
| 9+ | 32.4 |
| 18+ | 35.7 |

Female Cases.

| Age groups in years | Percentage of Female Cases |
|---|---|
| 0-3 | 5.1 |
| 3+ | 29.3 |
| 9+ | 32.8 |
| 18+ | 32.8 |

In working out the age and sex distribution of admissions, the figures of cases from Meru District have been considered separately in order to see whether the greater distances, which patients had to travel in order to get treatment, would result in a preponderance of male over female cases. In admissions from Kitui District, male cases were

68.1% of the total, but in admissions from Meru District, male cases were 76.4% of the total, the difference probably being due to the distances involved. In admissions from both districts, the percentage of cases in the various age groups remains pretty constant, about 60% of all patients being between three and seventeen years of age.

The figures above relate to the number of cases treated and to their age and sex distribution, but the manner in which the disease spread in epidemic proportions from location to location is also of interest.

In Tseikuru Location, where the epidemic first occurred, incidence was highest in January 1953 and remained high until the last two months of the year and ~~that~~ this location was worse affected than any other. In Mivukoni Location, to the south of Tseikuru, incidence was never high, but was highest from February to July 1953, thereafter becoming slight. In Ngomeni Location, to the southeast of Tseikuru, there were few cases before March 1953, but incidence rose subsequently, reaching a peak in June 1953. In Nuu Location, to the south of Ngomeni and in Endau, farther south still, the principle incidence was from March to July 1953. One got the impression that Tseikuru Location was the real seat

of the epidemic and that it spread thence as an epidemic wave, first to Tharaka and Mivukoni Locations and then south to Nuu and Endau.

Cases occurred in all the other locations of the district, excepting Kanziko, Ikutha, Mutomo and Nzambani, but not in any serious numbers. These were more likely to have been due to individuals entering the locations principly affected and being bitten, rather than due to kala azar occurring there. Exceptions were Zombe and Mutha Locations where infection definitely occurred, but not in serious proportions.

TREATMENT:

At the beginning of the epidemic, the routine treatment employed at the Kitui District Hospital was as follows.

After diagnosis, cases were given a ten-day course of pentamidine isethionate. Injections were given daily and an adult received 0.2 G. daily; this resulting in a total of 2 G. for the course. Children received smaller dosage, suitable for their age and size. Thereafter the patient had a seven-day rest period and this was followed by a second 2 G. course of pentamidine isethionate. Following seven days of rest, the patient commenced a urea stibamine course. Intravenous injections of urea stibamine were given on alternate days, the first injection for an adult consisting of 0.05 G. This was increased by 0.05 G. per injection till the maximum dose of 0.25 G. was reached, at which level injections continued until the patient had a total course of ten injections. The total amount given was 2.0 G. Thereafter the patient had seven day of rest and then a second 2.0 G. course of urea stibamine.

This method of treatment was very effective, but unfortunately took eighty one days to complete. While we had merely a handful of patients to treat,

this method of treatment was very satisfactory, but when cases appeared in ever-increasing numbers, it was obviously desirable to shorten it in some way or other, or to replace it. By the end of 1952 there were so many cases to treat that it was modified by cutting out one pentamidine isethionate course and one urea stibamine course. Patients then received a ten day course of pentamidine isethionate (2 G. total), then seven days rest then a urea stibamine course (2G.) . This method of treatment took thirty seven days and appeared to be quite effective. Subsequently the seven-day rest period was cut out. These modifications resulted in a shortening of the duration of treatment from 81 to 30 days and consequently increased the turnover of patients and reduced over-crowding, thereby relieving some of the strain on the staff and equipment.

The original 81-day course of treatment had been in use when I took over the Kitui Hospital in September 1951 and finding it most satisfactory I had continued to employ it. However, since pentamidine isethionate alone could not be relied upon to produce a negative spleen puncture, I decided to see whether urea stibamine, by itself, would produce as good results as the combined pentamidine isethionate - urea stibamine course, so the last change in the original

course of treatment was to cut out pentamidine isethionate altogether. This was done and many cases treated with urea stibamine alone, cases receiving urea stibamine injections till apparent clinical cure, but no case receiving more than 25 injections i.e. a total of 5.75 G. of urea stibamine.

In May 1953, pentostam (Burrows Welcome) was received and trial made of it. Adult males were given 6 cs. intravenously daily for ten days. Since however, such a ten day course of pentostam did not necessarily give a negative spleen puncture, it was decided to follow it up with pentamidine isethionate. This combined course of pentostam followed by pentamidine isethionate was most effective and was the routine course of treatment for the great majority of cases treated. Finally, as the incidence of the disease fell, there was less need for very rapid turnover of cases. In an attempt to ensure absence of relapses, a second pentostam course was used, the patient then getting ten days of pentostam, then ten days of pentamidine isethionate then ten days of pentostam. Finally a few cases were treated with 2 - amino-stilbamidine as a clinical trial of a new drug.

All these alterations and modifications of treatment were first tried out on cases at the Kitui District Hospital and if found to be satisfactory were

then carried out at the Treatment Centres, where the treatment had to be routine. While the aim was to obtain as short a course of treatment as possible which could be relied upon to effect cure, it was soon found to be necessary to retain patients under treatment for longer periods than their course of treatment actually required. Emaciated patients had to be kept in hospital for long periods before they were fit to be discharged. Consequently, while it was desirable to have as short a course as possible for the treatment of early and mild cases of the disease, a short course of injections was no advantage with severely ill, emaciated cases, who had to be retained till they had regained both strength and weight.

One problem was the criterion of cure. Obviously it would have been desirable to discharge patients only when they had regained normality in every respect, but as we had to treat an enormous number of cases, this criterion of cure was far too high. While the aim was to restore the patient to health as completely as possible, it was regarded as reasonable to treat them up to the point from which they would continue to improve after discharge from hospital. The following were our criteria:-

(1) Obviously a feeling of well-being. While on treatment with the various drugs, patients rapidly

improved and most were clamouring for discharge several days before we considered them as fit for discharge.

(2) In the emaciated cases, an increase in weight, not necessarily to the normal weight for their age and sex, but as near to it as possible.

(3) In febrile cases, disappearance of the fever. As will be seen later, this was usually quite soon effected.

(4) Disappearance of the splenomegaly or considerable reduction in the degree of splenomegaly. Early on in the epidemic, cases were not discharged till the splenomegaly had ceased. As a result, we had a lot of cases in hospital who felt and were perfectly well apart from having some degree of splenomegaly. However, we found that repeated courses of treatment had no effect on the splenomegaly. Many of these patients stated that they had had enlarged spleens long before they got kala azar. Under the circumstances it was considered that the residual splenomegaly after treatment was probably due to malaria and could not be expected to disappear. The writer considers that the response of the splenomegaly to treatment falls into one of two categories. In patients who have had previous splenomegaly due to chronic malaria or frequent mild attacks of malaria who are semi immunes, the spleen

shrinks to its former size and further kala azar treatment will have no effect on it. In the second group of patients, who have had no previous splenomegaly, the spleen shrinks rapidly under treatment and will disappear completely. Consequently it was felt that it was not unreasonable to discharge a patient as cured, who had a spleen of three fingerbreadths which obstinately refused to get any smaller, provided that the patient felt well, was afebrile, had gained in weight and whose blood picture was satisfactory.

(5) An improvement in the blood picture. Obviously the amount of laboratory work done on cases prior to discharge depended on the amount having to be done on new admissions, but haemoglobin estimations were done on most cases. We tried not to discharge cases who had a haemoglobin of less than 60% Sahli. It is realised that this level is low and that many kala azar cases present themsleves with haemoglobins considerably above 60%, but it was felt that a patient whose haemoglobin was above 60% would be able to continue to improve in this respect after discharge. Stress was laid on a rise in the haemoglobin and cases were not discharged till their haemoglobins were above 60%. Those who left with haemoglobins below this level, went of their own free will and against our

wishes and advice.

The above then were our criteria, a feeling of well-being, a gain in weight, disappearance of the spleen or considerable reduction in the splenomegaly and lastly an improvement in the blood picture.

Courses of Treatment:

These have been briefly described already. The following tables show the number of cases in the series of five hundred cases treated with various courses and the average duration of hospitalisation for complicated and uncomplicated cases.

(A) Urea Stibamine Alone.
Uncomplicated Cases.

| Number of Injections of Urea Stibamine. | Number of Cases treated. | Average days in Hospital. |
|---|---|---|
| 10 | 2 | 21 |
| 15 | 22 | 35.9 |
| 20 | 18 | 48.3 |
| 25 | 1 | 96 |
| Total Cases | 43 | |

Cases with Complications:

| Number of Injections of Urea Stibamine. | Number of Cases treated. | Average days in Hospital. |
|---|---|---|
| 10 | - | - |
| 15 | 5 | 63.4 |
| 20 | 9 | 54.6 |
| 23 | 1 | 59.0 |
| 25 | 1 | 98.0 |
| Total Cases | 16 | |

(B) Pentamidine Isethionate followed by Urea Stibamine.
Uncomplicated Cases.

| No. of Injections of Pentamidine Isèthionate. | No. of Injections of Urea Stibamine | No. of Cases. | Average Days in Hospital |
|---|---|---|---|
| 5 | 15 | 5 | 42.4 |
| 10 | 10 | 9 | 53.9 |
| 10 | 15 | 29 | 57.3 |
| 10 | 20 | 39 | 69.0 |
| 10 | 24 | 1 | 110.0 |
| 20 | 10 | 14 | 70.6 |
| 20 | 15 | 1 | 68.0 |
| 20 | 20 | 1 | 87.0 |
| | Total Cases | 99 | |

Cases with Complications.

| No. of Injections of Pentamidine Isethionate | No. of Injections of Urea Stibamine | No. of Cases | Average Days in Hospital |
|---|---|---|---|
| 5 | 15 | 3 | 40.6 |
| 5 | 20 | 2 | 52.0 |
| 10 | 10 | 5 | 43.4 |
| 10 | 15 | 15 | 70.0 |
| 10 | 20 | 13 | 68.6 |
| 10 | 24 | 1 | 112.0 |
| 15 | 20 | 1 | 76.0 |
| 20 | 10 | 9 | 71.6 |
| 20 | 15 | 3 | 90.0 |
| | Total Cases | 52 | |

(C) Pentamidine Isethionate Alone

| No.of Injections of Pentamidine Isethionate | Number of cases. | Average Days in Hospital. |
|---|---|---|
| 20 | 1 | 37 |

This was a very young child whose veins were too small to permit of intravenous injections of urea stibamine.

A summary of these tables is given below:-

| Treatment | Type of Cases | Number Treated | Average Days in Hospital. |
|---|---|---|---|
| Urea stibamine | Uncomplicated | 43 | 41.8 |
| Urea stibamine | Complicated | 16 | 60.3 |
| Pentamidine Isethionate & Urea Stibamine | Uncomplicated | 99 | 63.7 |
| Pentamidine Isethionate & Urea Stibamine | Complicated | 52 | 66.9 |
| Pentamidine Isethionate | Uncomplicated | 1 | 37.0 |
| Deaths before completion of treatment | | 18 | |
| Absconded before completion of treatment | | 9 | |
| | TOTAL | 238 | |

(D) Pentamidine Isethionate and Pentostam.
Uncomplicated Cases.

| No.of Injections of Pentostam | No.of Injections of Pentamidine Isethionate | No.of Cases treated | Average days in Hospital |
|---|---|---|---|
| 10 | 10 | 116 | 32.5 |
| 15 | 10 | 1 | 46 |
| 20 | 10 | 28 | 58 |
| 20 | 20 | 3 | 62.3 |
| | Total Cases | 148 | |

Cases with complications.

| No.of Injections of Pentostam | No.of Injections of Pentamidine Isethionate | No.of Cases treated | Average days in Hospital |
|---|---|---|---|
| 10 | 10 | 56 | 41.3 |
| 20 | 10 | 13 | 63 |
| 20 | 20 | 4 | 99.7 |
| | Total Cases | 73 | |

A summary of these tables is given below:-

| Treatment | Type of Cases | Number | Average Days in Hospital. |
|---|---|---|---|
| Pentamidine Isethionate and Pentostam | Uncomplicated | 148 | 38 |
| " | Complicated | 73 | 48.4 |
| | | 221 | |
| Deaths before completion of treatment | | 28 | |
| Absconded before completion of treatment | | 3 | |
| | TOTAL | 252 | |

Comparison of Courses of Treatment.

It has already been stressed that, due to the influx of patients, it was essential to use as short a course of treatment as possible. The principle courses of pentamidine isethionate and urea stibamine used were those consisting of ten injections of pentamidine isethionate, followed by either fifteen or twenty injections of urea stibamine, the former resulting in an average stay in hospital of 57.3 days and the latter in 69 days in uncomplicated cases. These courses were superseded by the use of urea stibamine alone, early in 1953. The principle courses used were those of fifteen injections and twenty injections, resulting in stays in hospital of 35.9 and 48.3 days respectively. In May 1953, urea stabimine was replaced by a course consisting

of ten injections of pentamidine followed by ten of pentostam. This resulted in further reduction of the stay in hospital of uncomplicated cases to 32.5 days.

The use of pentamidine and pentostam in place of the urea stibamine course had several other advantages. Since Pentostam is available as a made up solution the staff did not have to go to the trouble of breaking ampoules and dissolving the powder in distilled water. Secondly, since pentostam can be injected either intravenously or intramuscularly, it could be used for the treatment of very small children, whose veins were too small for intravenous injections. Thirdly, the patients preferred to have daily injections, as they felt that more was being done for them, most of them being quite unable to appreciate the need for the spacing of urea stibamine injections and considering that we were merely wasteing time. Fourthly, while the average gain in weight was the same for patients treated with pentamidine and pentostam as for those treated with urea stibamine, the fact that patients could be discharged sooner helped to obviate overcrowding, thereby allowing for better attention to individual patients and reducing the strain on the staff. Lastly, the new course caused the fever to cease, on an average, a week earlier than the previous urea stibamine course had done. For all these reasons

the patients, the staff and the writer were delighted with the new course of treatment, which was used routinely from May 1953 till mid 1954, by which time cases were presenting themselves in very small numbers and when it was obvious that the end of the epidemic was in sight. At that time, in the hope of preventing relapses, a further course of pentostam was added and patients were kept under treatment and observation for very much longer periods.

TREATMENT WITH OTHER DRUGS.

A drug, 2-amino-stilbamidine, was received from its manufacturers for clinical trial on kala azar. This, to the best of my knowledge, had not previously been tried on the disease and in consequence we had to proceed experimentally in order to discover an adequate dosage and an adequate spacing of injections. The manufacturers suggested s scale of dosage between one and two milligrames per kilo of body weight, daily or on alternate days. Consequently it was decided to try the drug with a dosage of 1.5 milligrammes per kilo. The following are case histories of patients treated with 2-amino-stilbamidine.

(1) Kitungu Thangila, an adult male, was admitted complaining of fever and pain in his spleen of one month's duration.

On examination, he was afebrile and his pulse rate within normal limits. There was little wasteing. His hair was normal and there were no skin changes. There was slight oedema of the ankles. Lymph glands were generally enlarged. His weight was 146 lbs. His spleen was enlarged six fingerbreadths and his liver palpable two fingerbreadths below the costal margin. There were no other clinical findings of note. On laboratory examination, the red blood count was 2,400,000/cmm and his haemoglobin 56% Sahli. His total leucocyte count was 3,100 with 45% neutrophil

polymorphs and 3% eosinophils. There was no monocytosis. The aldehyde test was positive within two minutes and spleen puncture was positive.

It was decided to treat him with daily intravenous injections of 2-amino-stilbamidine on the basis of 1.5 milligrammes per kilogramme of body weight. On this basis, he received 100 milligrames of 2-amino -stilbamidine daily, dissolved in sterile distilled water. He had twelve daily injections, receiving a total of 1.2 grammes of 2-amino-stilbamidine. During the course of treatment he developed diarrhoea, which responded to treatment with sulphaguanidine. He was afebrile throughout.

Thirteen days after completing his 12-day course of 2-amino-stilbamidine his spleen was only just palpable, as was his liver. His red blood count had risen to 3,500,000/cmm and his haemoglobin to 70%. Total leucocytes were now 4,100/cmm with 50% neutrophils and 10% eoseinophils. The spleen was too small for puncture.

He was held onto for further observation and thirty seven days after completing his course of 2-amino-stilbamidine his weight was 158 lbs (a gain of 12 lbs). His spleen was enlarged only one finger-breadth below the costal margin and his liver was only just palpable. His red blood count was 4,100,000/cmm

and his haemoglobin 80%. Total leucocytes were 5,700/cmm with 60% neutrophils and 5% eosinophils. Although his Haemoglobin and red blood count were not quite back to normal, they had improved considerably. His splenomegaly had almost disappeared and there had been a considerable increase in weight. He was considered to be cured and was discharged. Duration of stay in hospital was fifty seven days. Subsequently he did not relapse.

(2) Mulyunge Kisune, an adult male, was admitted complaining only of weakness and pain in his spleen of thirteen month's duration.

On examination his temperature was 102° and his pulse 116/minute. His skin and hair were normal and there was no oedema. Glands were generally enlarged. His weight was 105 lbs.

His spleen was seven fingerbreadths enlarged below the costal margin, but his liver was not enlarged. There were no other findings of note. On laboratory examination, his red blood count was 2,200,000/cmm and his haemoglobin 40% Sahli. Total leucocytes were 1,500/cmm with 39% neutrophils and 1% eosinophils. The aldehyde test was positive within one minute and spleen puncture was positive.

It was decided to treat him with 2-amino-stilba-

midine 1.5 mgms/Kilogramme of body weight, the injections being given intravenously on alternate days. On this basis he received 72 milligrames of 2-amino-stilbamidine per injection and a total of 864 milligrammes in the course. On this course of treatment there were no complications and he was afebrile within ten days of commencing treatment.

As, in the interval, other cases treated with 2-amino-stilbamidine had relapsed, he was held onto for 106 days. On discharge, he felt well and his weight was 126 lbs (a gain of 21 lbs). While his spleen was three fingerbreadths enlarged below the costal margin, it was soft and unsuitable for spleen puncture. His red blood count was 3,600,000/cmm and his haemoglobin 70%. Total leucocytes were 4,800 with 35% neutrophils and 7% eosinophils. As he was keen to get out of hospital, he was discharged as a possible cure.

(3) Ndambuki Mzalu, a male aged about 25 years, was admitted complaining of weakness and pain in the spleen. He had been treated with ten injections of pentostam and ten of pentamidine ten months previously and had begun to feel unwell three months after discharge from hospital.

On examination, he was afebrile and his hair and skin were normal. Glands were uniformly enlarged and there was slight oedema of his ankles. His weight

was 120 lbs. His abdomen was distended, but there was no ascites. The spleen was six fingerbreadths and the liver three fingerbreadths below the costal margin.

On laboratory examination, his red blood count was 1,600,000/cmm and his haemoglobin 40% Sahli. Total leucocytes were 1,400/cmm with 46% neutrophils and absent eosinophils. The aldehyde test was positive within two minutes and spleen puncture positive.

On a basis of 1.5 mgms of 2-amino-stilbamidine per kilogramme of body weight, he received 82 mgms of the drug intravenously on alternate days for twelve injections, a total of 984 milligrammes for the total course. He was afebrile throughout and there were no complications.

Fifty two days after completing his course of 2-amino-stilbamidine and just prior to discharge from hospital, his weight was 130 lbs (i.e. a gain of 10 lbs). His spleen tip was only just palpable and his liver was no longer palpable. His red blood count was 3,000,000 and his haemoglobin 60%. These while still low, represent a considerable rise from the results before treatment. Total leucocytes were 2,400 with 38% neutrophils and 1% eosinophils. Although blood findings were not yet normal, there had been a considerable gain in weight and reduction in the size of the liver and spleen. It was felt

that this man had probably been cured, so he was discharged, having been in hospital for 81 days.

(4) Musya Muasya, an adult male, was admitted complaining of pain in his spleen and fever of three month's duration. He had a recent severe cough.

On admission, he was febrile, with a temperature of 101°. Skin and hair were normal and there was no oedema. Lymph glands were very small. His weight was 98 lbs. His spleen was eight fingers and his liver two finger enlarged beneath the costal margin. Chest examination revealed numerous rhonchi.

On laboratory examination, his red blood count was 2,000,000/cmm and his haemoglobin 40% Sahli. Total leucocytes were 1,700/cmm with 33% neutrophils and absent eosinophils. The aldehyde test was positive within two minutes. His severe and frequent cough, due to acute bronchitis, foiled an attempt at spleen puncture. On the other hand, there was no doubt that on clinical grounds he was suffering from kala azar.

He was treated with 2-amino-stilbamidine on a basis of 1.5 mgms/Kilogramme of body weight intravenously on alternate days, receiving 66 milligrammes per injection i.e. a total of 792 milligrammes.

Bronchitis continued to be troublesome, but he became afebrile after twenty one days. Twelve days after his course was completed, his weight was 100 lbs.

His spleen was six fingerbreadths enlarged. His red blood count was 3,300,000/cmm and his haemoglobin 70%. Total leucocytes were 6,400/cmm with 38% neutrophils and 2% eosinophils.

Twenty eight days after his course, his weight was 101 lbs (i.e. a gain of three pounds only). His spleen tip and his liver were only just palpable. His red blood count was 3,600,000/cmm and his haemoglobin 76%. Total leucocytes were 5,200 with 48% neutrophils and 16% eosinophils. (It is noted that two of these cases had high eosinophil counts after treatment).

In view of the almost complete disappearance of liver and spleen and in view of the improvement in his blood picture, this patient was discharged as cured, having been 62 days in hospital.

(5) Mulu Mutungi, a male aged about 25 years, was admitted, complaining of weakness and pain in his spleen, of fourteen months duration.

On examination, he was afebrile. Skin and hair were normal and there was no oedema. The usual glandular enlargement was present and his weight was 123 lbs. His spleen was enlarged six fingerbreadths and his liver palpable one fingerbreadth below the costal margin. There were no other findings of interest.

On laboratory examination, his red blood count

was 2,900,000/cmm and his haemoglobin 55% Sahli. Total leucocytes were 6,200 with 37% neutrophils and 3% eosinophils. The aldehyde test was positive in two minutes and spleen puncture was positive.

On the basis of 1.5 mgms of 2-amino-stilbamidine per kilogramme of body weight, he received 84 milligrammes of the drug intravenously daily for twelve days, i.e. a total of 1008 milligrammes. Reports of laboratory examinations have unfortunately been lost but fourteen days after completing his course, his spleen was between three and four fingerbreadths below the costal margin. He was found to be suffering from amoebic dysentry and this was treated. As his spleen appeared to be enlarging, the 2-amino-stilbamidine course was repeated, on the previous dosage and on discharge from hospital, after 89 days hospitalisation, his weight was 135 lbs. and his spleen only two fingerbreadths enlarged. It is considered that in view of the gain of 12 lbs. in weight and the reduction in the size of the spleen, this can probably be claimed as a cure.

(6) Nginyangi Mbugi, a male aged about twenty five years, was admitted complaining of pain in his spleen of one month's duration. Twelve months previously, he had been trated with ten injections of pentamidine and ten of pentostam and had felt perfectly well

until one month previous to readmission.

On examination, he was afebrile. Skin and hair were normal and there was no oedema. Glands were uniformly enlarged and his weight was 119 lbs. His spleen was six fingerbreadths enlarged and his liver palpable one fingerbreadth below the costal margin.

On laboratory examination, his red blood count was 4,200,000/cmm and his haemoglobin 70% Sahli. Total leucocytes were 4,200/cmm with 26% neutrophils and absent eosinophils. Aldehyde test was, strictly speaking, negative, the serum-formalin mixture only solidifying after 25 minutes. Spleen puncture was positive.

On the basis of 1.5 mgms of 2-amino-stilbamidine per kilogramme of body weight, he received 80 milligrammes of the drug intravenously on alternate days for twelve injections i.e. a total of 960 milligrammes for the course. The course commenced on 29.5.54. He was afebrile throughout treatment and twenty days after the course, his weight was 118 lbs (i.e. a loss of 1 lb). His spleen was still six fingerbreadths enlarged and his blood picture had deteriorated. His red blood count was 3,400,000 (i.e. a drop of 800,000) and his haemoglobin 70% (Unchanged). Total leucocytes were 4,400 with 15% neutrophils and absent eosinophils, i.e. a drop in the neutrophils.

Spleen puncture was again positive.

Seventeen days after these unsatisfactory findings, there had been no improvement in his condition, so the 2-amino-stilbamidine course was repeated (on 9.7.54) On completion of this second course his spleen was still six fingerbreadths below the costal margin. His red blood count had fallen still further, to 2,900,000/cmm, that is a fall of 1,300,000/cmm since admission and his haemoglobin was 60% (i.e. a fall of 10%). Total leucocytes were now 3,800/cmm with 34% neutrophils and 2% eosinophils. Spleen puncture was, for the third time, positive.

Ten days later, on 12.8.54, he was feeling far from well and it seemed unfair and inadvisable to wait for delayed improvement as a result of the 2-amino-stilbamidine courses. In view of the third spleen puncture having been still positive, it was considered that 2-amino-stilbamidine had failed, so he commenced a pentostam course, 6 cs intravenously for ten days. Ten days after completion of this course his weight had increased considerably to 125 lbs (i.e. a gain of six pounds since admission) and his spleen was five fingerbreadths enlarged. His red blood count was 4,600,000/cmm and his haemoglobin now 85%. Total leucocyte count was still low - 3,500/cmm with 46% neutrophils and 1% eosinophils. The patient refused

to be spleen punctured again. Treatment was for 102 days.

This is an interesting case which 2-amino-stilbamidine failed to cure and which was cured by pentostam. The patient did not subsequently report back, so it is unknown whether there was any further reduction in the splenomegaly.

(7) Lelo Iloi, an adult male, was admitted complaining of weakness and pain in the spleen of thirteen month's duration.

His temperature was 101° on admission. Skin and hair were normal and there was no oedema. Lymph glands were enlarged and his weight was 108 lbs. His spleen was enormous, being nine fingerbreadths below the costal margin and his liver three fingerbreadths.

Before treatment, his red blood count was 2,400,000/cmm and his haemoglobin 50% Sahli. Total leucocytes were 2,500 with 38% neutrophils and absent eosinophils. The aldehyde test was positive in two minutes and spleen puncture was positive.

On the usual basis of 1.5 milligrammes of 2-amino-stilbamidine per kilo of body weight, he received 74 milligrammes of the drug intravenoursly on alternate days for 12 injections, i.e. a total dosage of 888 milligrammes. This course commenced on 23.5.54.

He became afebrile within ten days. Twenty five

days after completion of the course his condition was unchanged. The spleen was as before. The red blood count was 2,000,000 and his haemoglobin 50%. Total leucocytes were 2,400/cmm with 47% neutrophils and eosinophils were still absent. Spleen puncture was positive, the Leishman-Donovan Bodies being scantier than before.

On 9.7.54 the 2-amino-stilbamidine course was repeated. Three days after its completion, his spleen was unchanged. The red blood count was slightly improved, 3,000,000/cmm and haemoglobin also showed some improvement, 60% Sahli. The total leucocyte count was 3,900/cmm with 67% neutrophils and eosinophils of 2%. These results showed a general improvement, but as the spleen still continued huge, a third spleen puncture was performed. It again showed scanty parasites. Consequently, two days later, on 24.8.54, the patient commenced a pentostam course. On completion of this course, the patient's weight was 114 lbs (a gain of 6 lbs). The liver was still three fingerbreadths enlarged and the spleen still huge, being eight fingerbreadths below the costal margin. Unfortunately, the patient proved refractory and refused to be spleen punctured for a fourth time or to have any laboratory tests performed. He was discharged, having been under treatment for 105 days.

This case illustrates the inability of two courses of 2-amino-stilbamidine to eradicate the parasites.

(8) Mui Nduta, a male aged about twenty two years, was admitted after having been ill for three months. He complained only of pain in his spleen.

On examination, he was afebrile. Skin and hair were normal. There was no oedema. Lymph glands were enlarged and his weight was 119 lbs. His spleen was six fingerbreadths enlarged and his liver palpable one fingerbreadth below the costal margin.

His red blood count was 2,200,000/cmm and his haemoglobin 50%. Total leucocytes were 1,600/cmm with 23% neutrophils and 2% eosinophils. The serum formalin mixture showed solidification after 25 minutes. The spleen puncture was positive.

He was treated with 80 milligrammes of 2-amino-stilbamidine intravenously on alternate days to a total of 12 injections. The total amount of the drug given was 960 milligrammes. The usual basis of 1.5 milligrammes per kilogramme of body weight was employed.

Diarrhoea was a complication, but cleared up. Thirty three days after completion of the course, his spleen was impalpable. His red blood count was 3,900,000/cmm and his haemoglobin 75%. Total leucocytes were 4,800/cmm with 60% neutrophils and 3% eosinophils.

Forty six days after the course, his weight was 127 lbs. i.e. a gain of 8 lbs. His spleen was impalpable Red blood count was 4,000,000/cmm and haemoglobin 80%. Total leucocytes were 6,800/cmm with 52% neutrophils and 5% eosinophils. He was considered cured and discharged, having been in hospital 78 days.

One and a half months later he was re-admitted. His weight was 129 lbs (2 lbs more that on discharge). His spleen was four fingerbreadths enlarged, his liver being impalpable.

Blood examination showed deterioration, his red blood count being now 2,900,000/cmm and his haemoglobin only 50%. Total leucocytes were 1,900/cmm with 57% neutrophils and 1% eosinophils. The aldehyde test was now positive in two minutes. Since he was a proved kala azar case in relapse, spleen puncture was not repeated.

Treatment was again with 2-amino-stilbamidine, 88 milligrammes <u>daily</u> for twelve days, commencing on 11.9.54. His previous course had been given on alternate days.

Fifteen days after the course, his spleen was impalpable. The red blood count was 3,200,000/cmm and the haemoglobin 70%. Total leucocytes were 5,200. He had gained seven pounds in weight.

Subsequently, however, his spleen started to

enlarge, so the course was repeated, commencing on 2.11.54. Twenty days after completion, his weight was 140 lbs. His spleen tip was only just palpable. The red blood count was 3,500,000 and haemoglobin 75%.

Since he had twice relapsed after 2-amino-stilbamidine, he was given a course of pentostam. Hospitalisation was for 125 days. He did not again relapse during the next four months, at the end of which period, the writer left Kitui District.

These eight cases were chosen at random from a larger number treated. Five of them were apparently cured. Three of them relapsed within a month or two of completing courses of treatment. This drug was not popular with the patients, as was pentostam. Several patients complained of a peculiar metallic taste in their mouths while having the injections. Trigeminal neuropathies were not seen, but one patient not in this series, developed generalised pruritus towards the end of a second course of 2-amino-stilbamidine. In view of the rather poor results obtained in treating cases with this drug in the Kitui District Hospital, it was not used in the Treatment Centres. In the opinion of the writer, it may be useful in cases where treatment with pentostam and pentamidine has proved inadequate.

STIBATIN:

This drug was used on three cases, but was found to be no better than pentostam.

Results of Treatment:

The criteria of cure have already been discussed and it has been pointed out that while it would have been desirable to have restored all cases completely to normality, the rate at which patients presented themselves for treatment made this impossible.

In the five hundred cases, as representative of the entire epidemic, the following results were obtained:-

(1) Weights: While some cases failed to gain in weight and a few, in fact, lost several pounds, the average weight gain was 3.2 lbs.

(2) Splenomegaly: It is emphasised that malaria is endemic and splenomegaly due to malaria is common. Splenomegaly responded to treatment as follows:-

| | Percentage of Cases. | |
|---|---|---|
| Disappearance of the spleen | 24.1% | |
| Spleen of one fingerbreadth on discharge | 19.2% | |
| " " two " " " | 22.0% | |
| " " three " " " | 16.5% | |
| " " four " " " | 10.9% | 18.2% |
| " " five " " " | 2.8% | |
| " " six " " " | 3.8% | |
| " " seven, eight & nine " | 0.7% | |

From this table, it can be seen that in 81.8% of cases which survived, the spleen on discharge had either disappeared or was less than four finger-breadths enlarged. This is in contrast to 86.8% of spleens being four finger-breadths or larger on admission.

(3) Haemoglobin: The haemoglobin levels on discharge were as follows:-

| | Percentage of Cases. |
|---|---|
| Under 49% haemoglobin on discharge | 4.1% |
| 50% to 59% " " " | 15.8% |
| 60% to 69% " " " | 43.1% |
| 70% to 79% " " " | 29.7% |
| 80% and over " " " | 7.3% |

From this, 80.1% of cases were discharged with haemoglobin of 60% and over, this being on contrast to 64.6% of cases having haemoglobin levels of under 60% on admission.

(4) Total Leucocyte Counts. The average count on discharge was 5,600/cmm, in contrast with an average total leucocyte count before treatment of 3,900/cmm. The average percentage of neutrophil polymorphs on discharge was 51%, in contrast to 32.2% prior to treatment.

RELAPSES:

In 1954, one hundred and seventeen cases were readmitted for treatment for a second time. It is a matter of opinion whether these were relapses or reinfection. However, it was the writer's experience that when cases relapsed, they did so very shortly after discharge and were usually back seeking treatment within three or four months. These cases, obviously true relapses, were not usually so ill as cases presenting themselves for the first time. The other feature about them was that all the physical signs were usually very gross indeed. Spleens, in relapse, appeared to enlarge at a very rapid rate, with the result that cases returning within four months would have enormous spleens, with their lower poles in the right iliac fossae. Spleen puncture usually showed a large number of Leishman Donovan Bodies. Livers were large and oedema was common. Such cases were very obviously relapses, but many of the one hundred and seventeen cases appearing for the second time had been treated a year or more in the past. It is likely that these were reinfections, for patients, on discharge from hospital returned to their own villages, where nothing had been done to protect them from sandflies.

DEATHS:

Deaths in the series of five hundred cases were due to the following causes:-

(1) Cases treated with Urea Stibamine Alone and with Pentamidine Isethionate & Urea Stibamine.

| | Males | Females | |
|---|---|---|---|
| Bronchopneumonia | 2 | 2 | |
| Lobar pneumonia | 2 | - | |
| Gastroenteritis | 4 | - | |
| Anaemia with pregnancy | - | 1 | |
| Asthemia | 2 | - | |
| Measles with bronchopneumonia | 2 | - | |
| Sensitivity to Urea Stibamine | 2 | - | |
| Hypoglycaemia due to Pentamidine | 1 | - | |
| TOTALS | 15 | 3 | 18 |

(2) Cases treated with Pentostam & Pentamidine Isethionate.

| | | | |
|---|---|---|---|
| Lobar Pneumonia | 2 | - | |
| Gastroenteritis | 6 | 4 | |
| Asthemia | 3 | 1 | |
| Measles with bronchopneumonia | 3 | 1 | |
| Measles with enteritis | - | 1 | |
| Pertussis | - | 1 | |
| Bacillary Dysentary | 4 | - | |
| Acute Yellow Atrophy of Liver | 1 | - | |
| Lobar pneumonia with amoebic dysentery | 1 | - | |
| TOTALS | 20 | 8 | 28 |

With regard to the entire epidemic, the death-rate was low. In 1952, there were seven deaths of patients who commenced treatment on or after September. In 1953, there were ninety and in 1954, there were fourteen. The death-rates for these years are given below:-

| Year | Total Cases Treated | Deaths | Death-rate per cent. |
|---|---|---|---|
| 1952 | 149 | 7 | 4.3 |
| 1953 | 1994 | 90 | 4.5 |
| 1954 | 682 | 14 | 2.1 |

POST KALA AZAR.

DERMAL LEISHMANOID.

In all, six cases of this condition were seen in the epidemic, but only three are reported upon here. Their case histories are as follows:-

(1) KULA MUNYWOKI, a male aged about fifteen years, was treated with ten injections of pentamidine isethionate followed by fourteen injections of urea stibamine in May and June 1953. He complained that the rash started four months later, in October 1953. On 20.2.54, he was readmitted to hospital for treatment.

On examination, there was a marked, papular pigmented rash on his face. On the dorsa of both hands and on both forearms there were many small depigmented areas.

He felt perfectly well and his nutrition was good. Liver and spleen were not enlarged. Laboratory findings were as follows:-

Haemoglobin 80% Sahli. R.B.C's 4,050,000/cmm.

W.B's 4,200/cmm.

| | | |
|---|---|---|
| Differential Count: | Neutrophil polymorphs | 27% |
| | Eosinophil polymorphs | 3% |
| | Monocytes | 1% |
| | Lymphocytes | 69% |

Aldehyde Test: No opacity in one hour.

The total leucocyte count was rather low and in the differential count the neutrophils were very low.

but his general condition, which was excellent, and the absence of splenomegaly suggested that he was not suffering from active, generalised kala azar.

He was treated with two course of pentostam without any effect on the rash. He was subsequently transferred to Nairobi for further treatment.

(2) MUSUNZA MUNYWOKI, an adult male had previously been treated with pentostam and pentamidine isethionate and three months later began to suffer from a rash. Three months later, on 21.12.54, he was admitted to the District Hospital, Kitui for treatment.

On admission, he had a marked, papular, pigmented rash all over his face. The papules were very hard, each one being about the size of a lentil. On his back and on his arms there were numerous small depigmented patches, where the patient stated he had had a raised rash similar to that present on his face on admission.

His general condition was excellent. He was not anaemic and the spleen tip was only just palpable. There was nothing to suggest that he was suffering from kala azar. He was treated from 22.12.54 to 31.12.54 with a 2 G. course of pentamidine isethionate. On discharge from hospital on 10.1.55, the rash was very considerably reduced.

(3) MUSEMBI MBEVO, a male aged about 19 years, had

been treated in November 1953 with pentostam and pentamidine isethionate. When readmitted on 6.9.54, he felt perfectly well, but had had a rash for two months.

On examination, there was a marked papular rash on his face, on the upper part of the front of his chest and the upper part of his back. The rash was most marked on his face and there was very little on his back. The limbs and abdomen were not affected. While the papules were hard to the touch, they were much smaller than in the previous two cases, each being about the size of a pin-head.

His general condition was excellent. The spleen tip was palpable two fingerbreadths below the costal margin and the laboratory picture was as follows:-

Haemoglobin 100% Sahli R.B.C. 4,790,000/cmm.

W.B.C 5,500/cmm.

| Differential: | | |
|---|---|---|
| | Neutrophils | 21% |
| | Eosinophils | 16% |
| | Monocytes | 1% |
| | Lymphocytes | 62% |

Aldehyde Test: No opacity in one hour.

He was treated with a 2 G. course of pentamidine and ten injection of pentostam. On discharge, eight days after completion of the course, the rash had disappeared completely from his face and back and only a few papules were remaining on the front of his chest.

As can be seen from the accompanying photograph of a patient, the rash can be a considerable disfigurement, which the patient is very anxious to have cured. The writer found, from perusal of the textbooks, very little on how to cure it, most books suggesting that a repetition of treatment will clear up the rash. In the writer's opinion, based on the treatment of these three and other cases, antimonials such as urea stibamine and pentostam have very little, if any, effect on the rash. Pentamidine Isethionate on the other hand, appears to have a marked effect, the rash being almost completely cleared up at the end of the course. In one case, a second course of the drug was necessary to effect a cure.

The writer wishes to express his thanks to the Honourable Director of Medical Services, Kenya, for permission to present an account of the work in connection with the kala azar epidemic in the form of a thesis.

Refer to this map as 1:500,000 NAIROBI E.A.F. No. 1539.

ZONE H

# KITUI DISTR

## Shewing Locations

MIVUKONI
MUMONI
KATSE
TSEIKURU
NGOMENI
NDUI
MAGWANI
MUI
MUTITO
BUBONI
ENDAU
ZOMBE
MULANGO
IKANGA
YATTA
MUTHA
CROWN LAND
KOKANI
GALOLE
HIRAMAN
Dense Bush
Thorn Bush
Medium Thorn
Light Bush and Patches of Open Plains
Open Obstruction
Light Patches